

USFS National Flow Gage

Gap Analysis - Region 4



Stream gage on the Boise River, Idaho, USGS



Prepared by

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Commissioned by
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Introduction

The purpose of this study is to review the location of stream gages across the region that are located on, or near, US Forest Service land, and to determine where there are gaps in the distribution of gages across the region.

Questions answered by this analysis include:

- What proportion of the lands in Region 4 are NFS lands?
- What is the extent of the stream network in the region?
- Where are the operational stream gages?
- Where have gages been discontinued?

Data presented in these slides were obtained from the following:

- **Streams:** stream layers (1:100K) were downloaded from the NHDPlus website:
<http://www.horizon-systems.com/nhdplus/data.php>
- **Gages:** 1,950 stream gage locations were downloaded from the USGS website:
<http://waterservices.usgs.gov/rest/Site-Test-Tool.html>

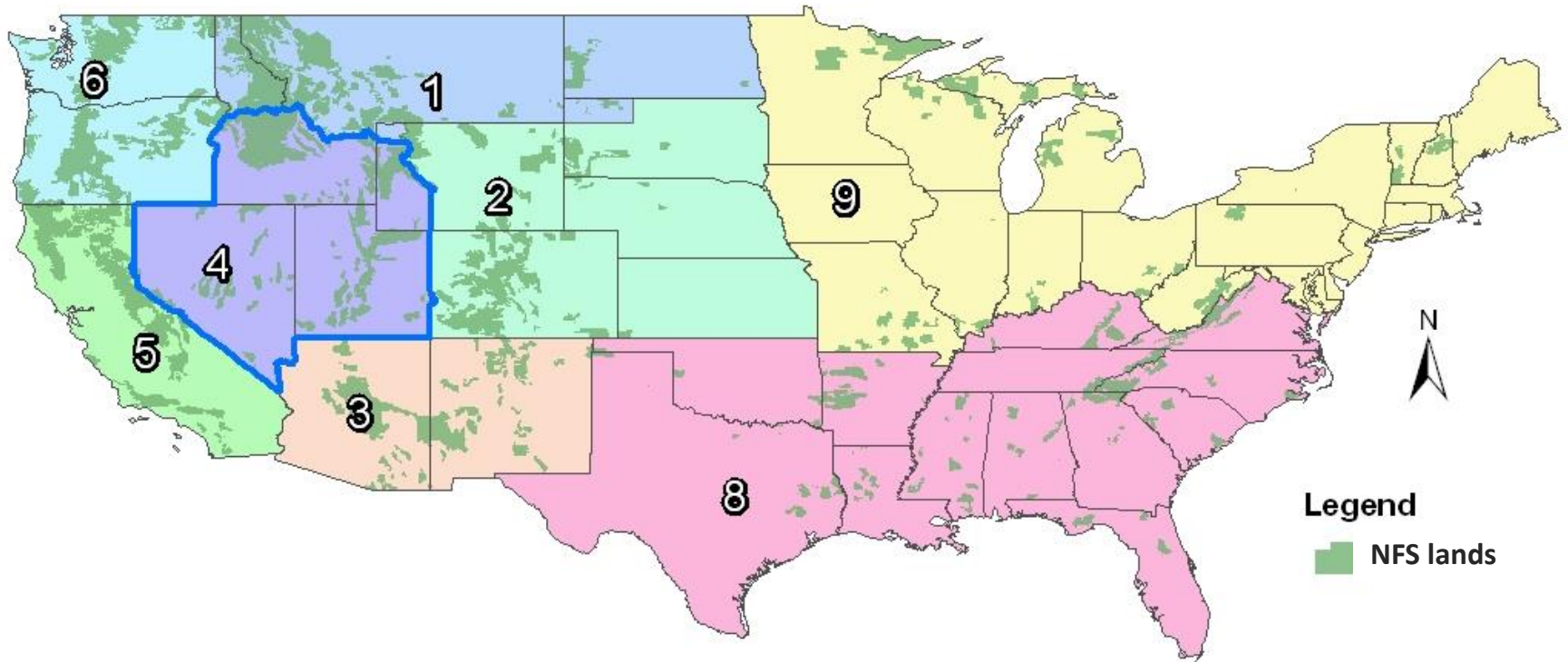
A note about the gage data:


Gage data were downloaded in winter 2014. We assumed that gages having no data beyond 12/31/09 were inactive and were labeled “Historic” in this analysis. Gages that had data past 1/1/10 were considered “Current” in the event their data had not yet been added to the website.

Summary Data

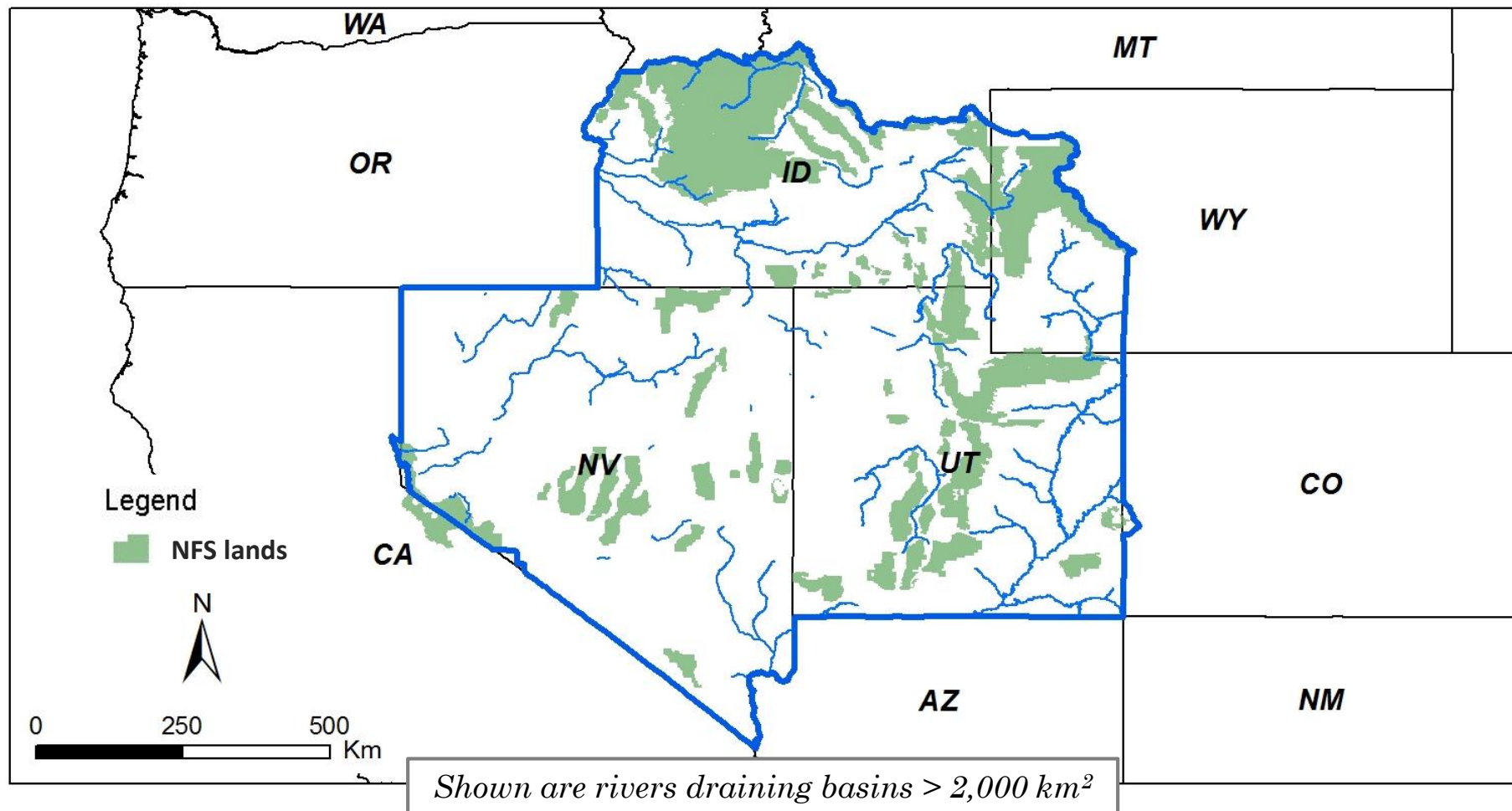
Attribute	On NFS lands in Region 4	All of Region 4	% NFS vs. Region 4
Land Area (Km ²)	135,349	722,538	18.7
Stream Length (km) (for basins >4 km ²)	58,388	321,579	18.2
Number of Historic Gages	329	1,433	23.0
Number of Current Gages	107	497	21.5

USFS Regions in Lower 48



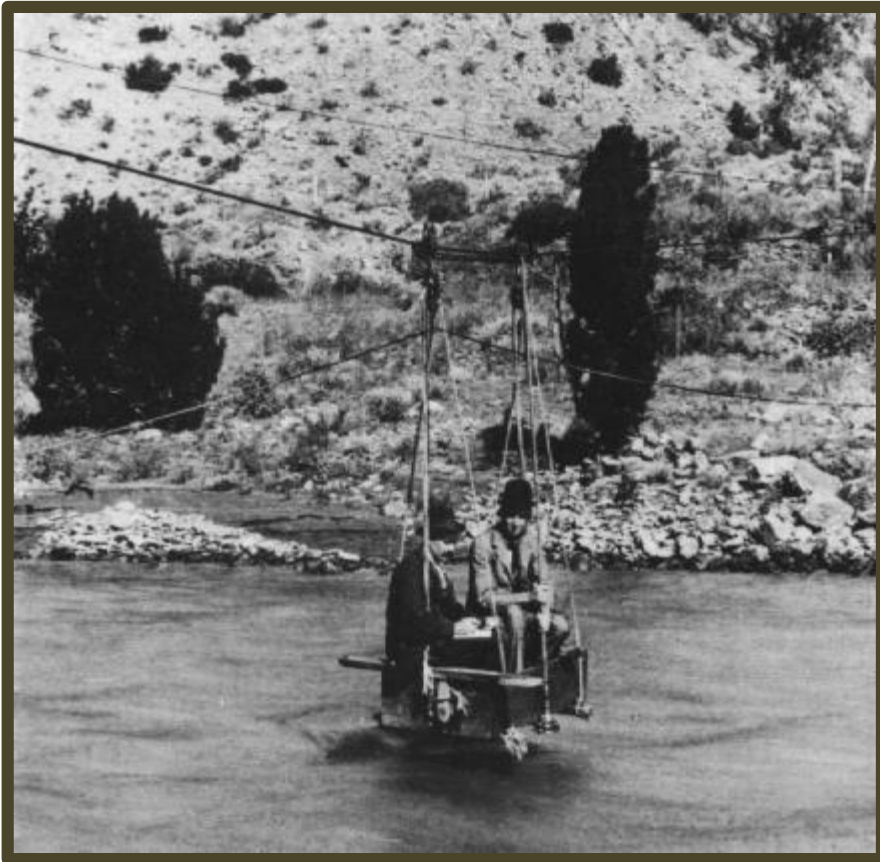
	NFS lands  in R4	All lands in R4	% NFS land in R4
Area (Km ²)	135,349	722,538	18.7

River Network in Region 4



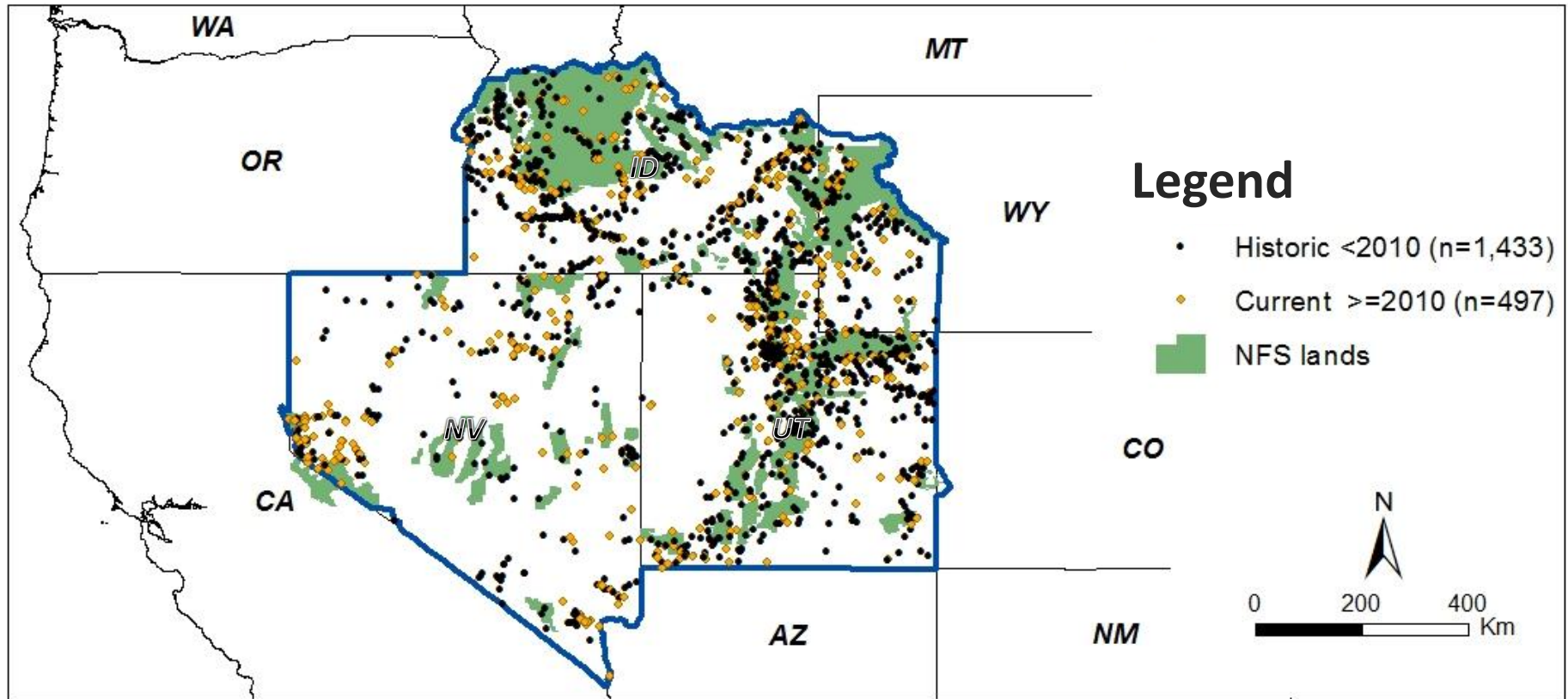
	NFS streams in R4	All streams in R4	% NFS streams in R4
Stream Length (km) (for basins >4 km²)	58,388	321,579	18.2

The following slides show the location of **USGS gages**
having discharge data collected from **1912 - 2012**



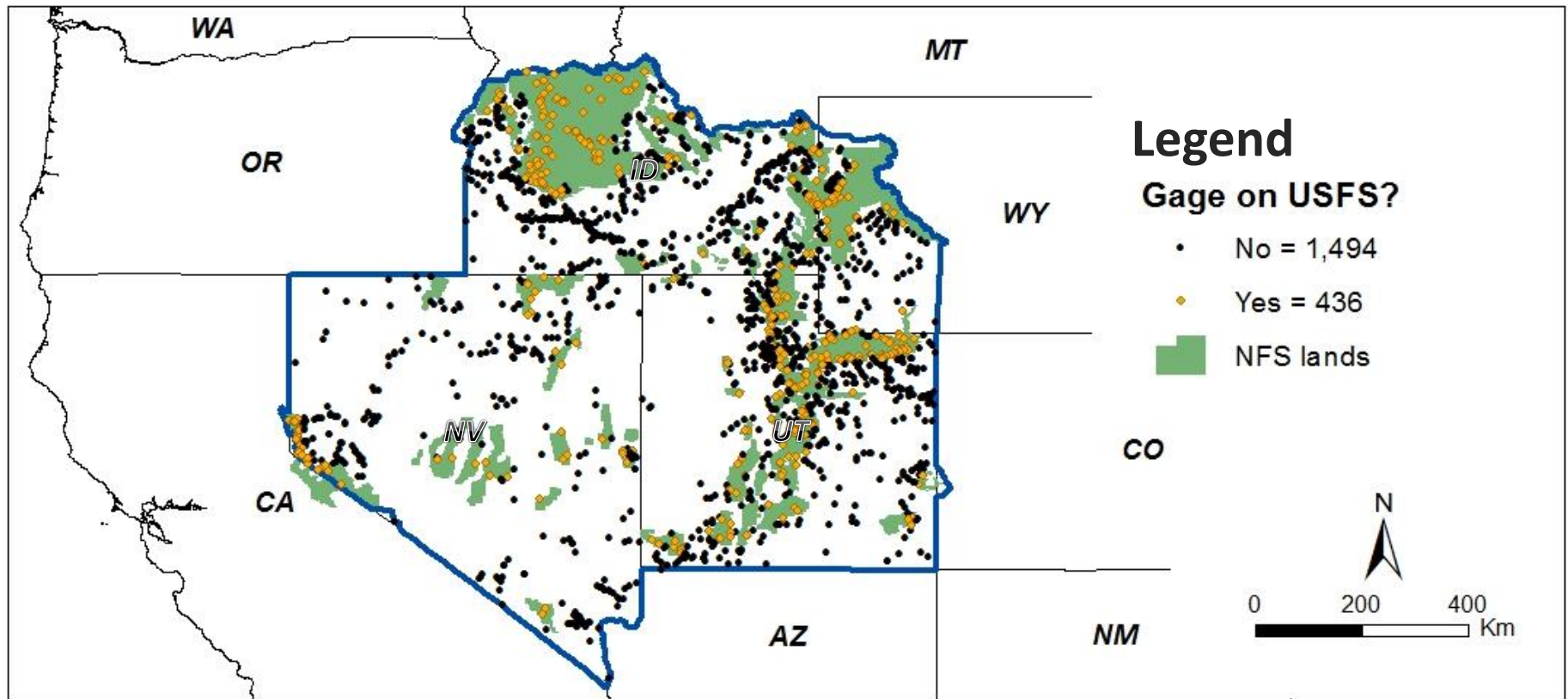
An early method of stream gaging (circa 1890).

Historic and Current USGS Stream Gages from 1912 - 2012 (n=1,930)



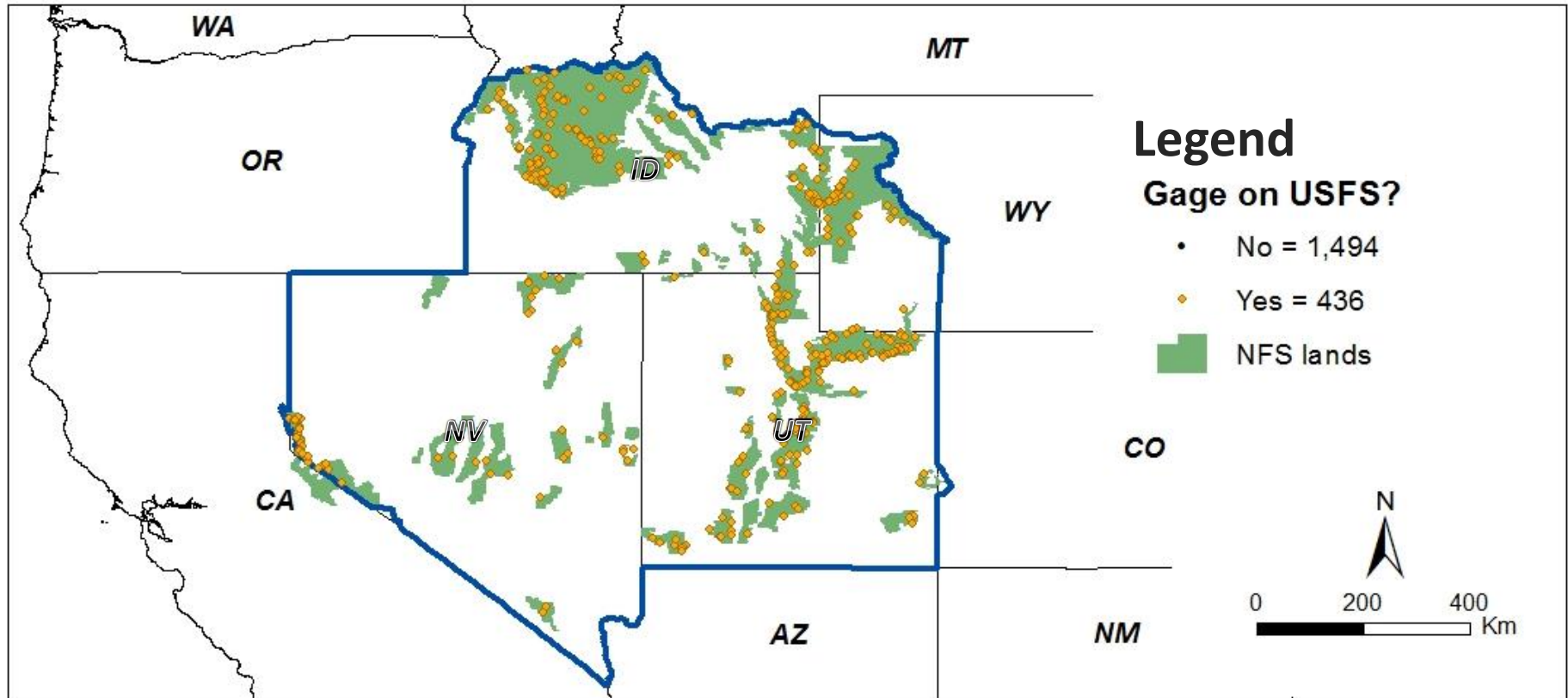
	Gages on NFS lands in R4	All gages in R4	% Gages on NFS lands in R4
Historic Gages	329	1,433	23.0
Current Gages	107	497	21.5

USGS Stream Gages from 1912 - 2012: Identifying those off and on NFS Lands



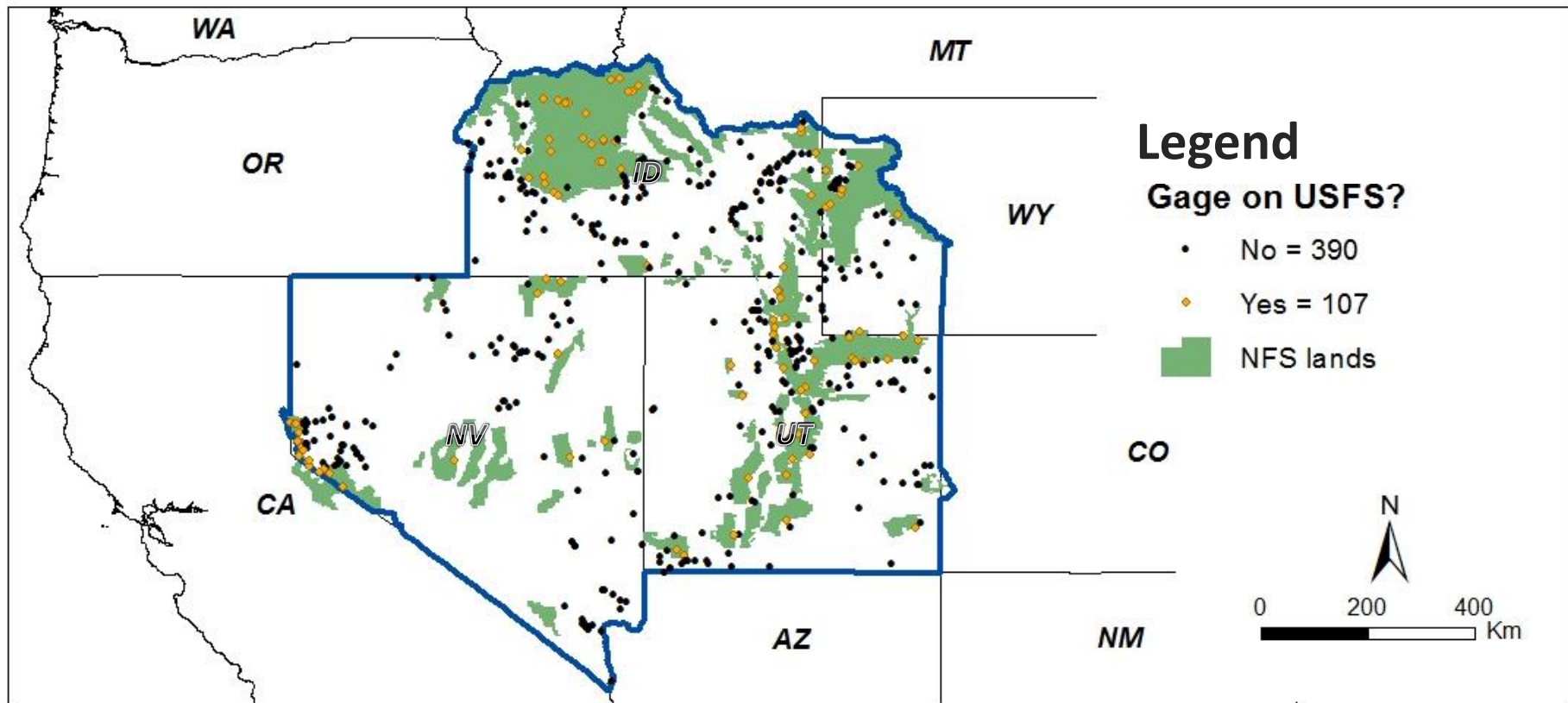
	Gages on NFS lands in R4	All gages in R4	% Gages on NFS lands in R4
Gages	436	1,930	22.6

USGS Stream Gages from 1912 - 2012: Only those on NFS Lands



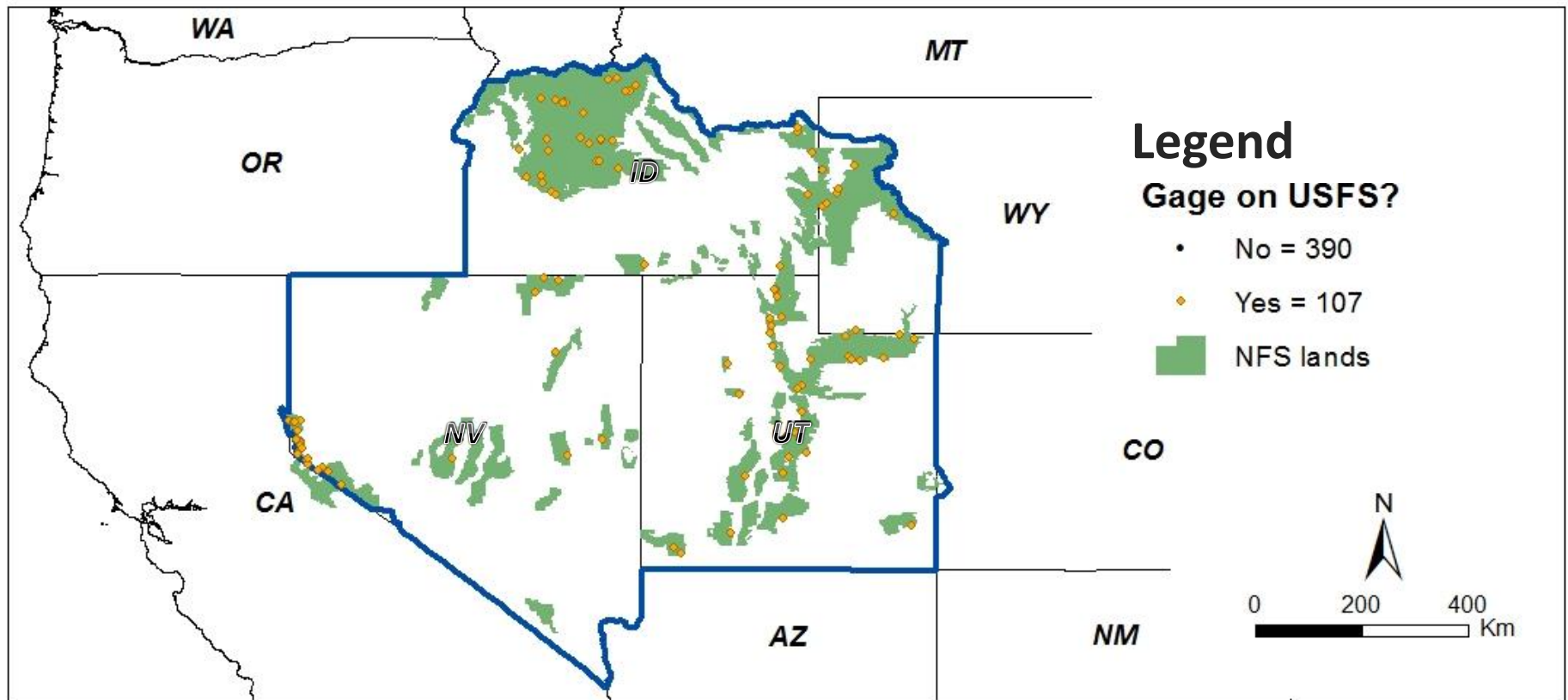
	Gages on NFS lands in R4	All gages in R4	% Gages on NFS lands in R4
Gages	436	1,930	22.6

USGS Stream Gages Currently Operational: Identifying those off and on NFS Lands



	Gages on NFS lands in R4	All gages in R4	% Gages on NFS lands in R4
Current Gages	107	497	21.5

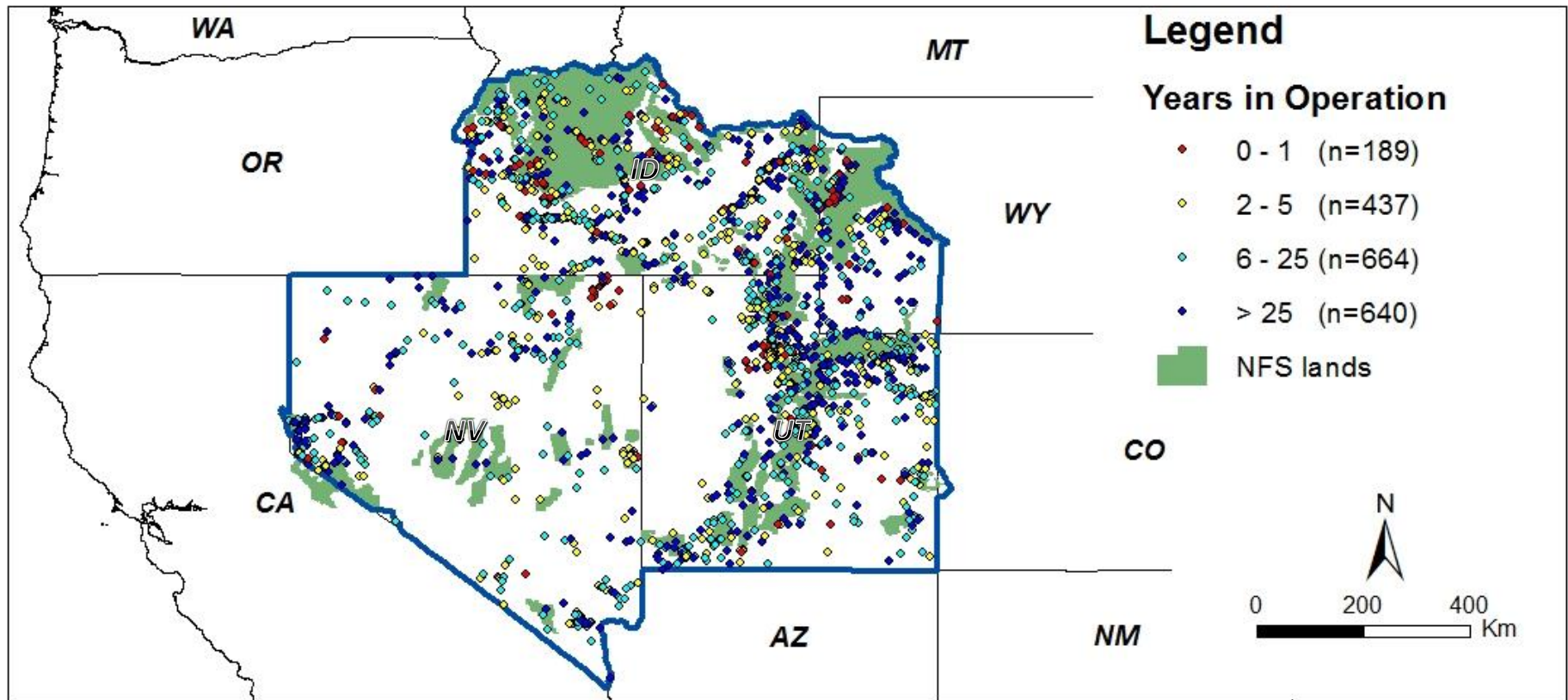
USGS Stream Gages Currently Operational: Only those on NFS Lands



	Gages on NFS lands in R4	All gages in R4	% Gages on NFS lands in R4
Current Gages	107	497	21.5

Years in Operation

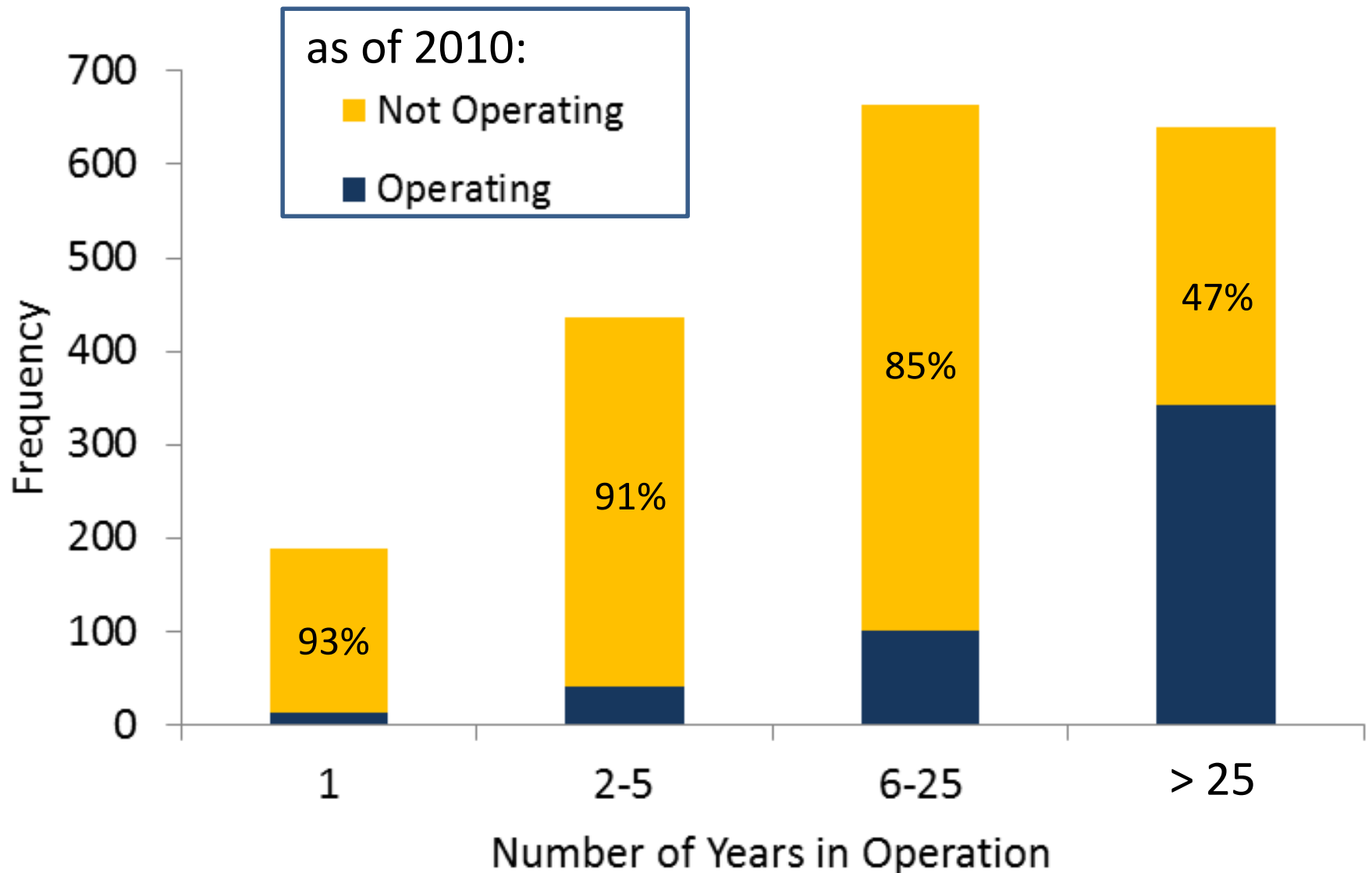
USGS Stream Gages from 1912 - 2012 (n=1,930)



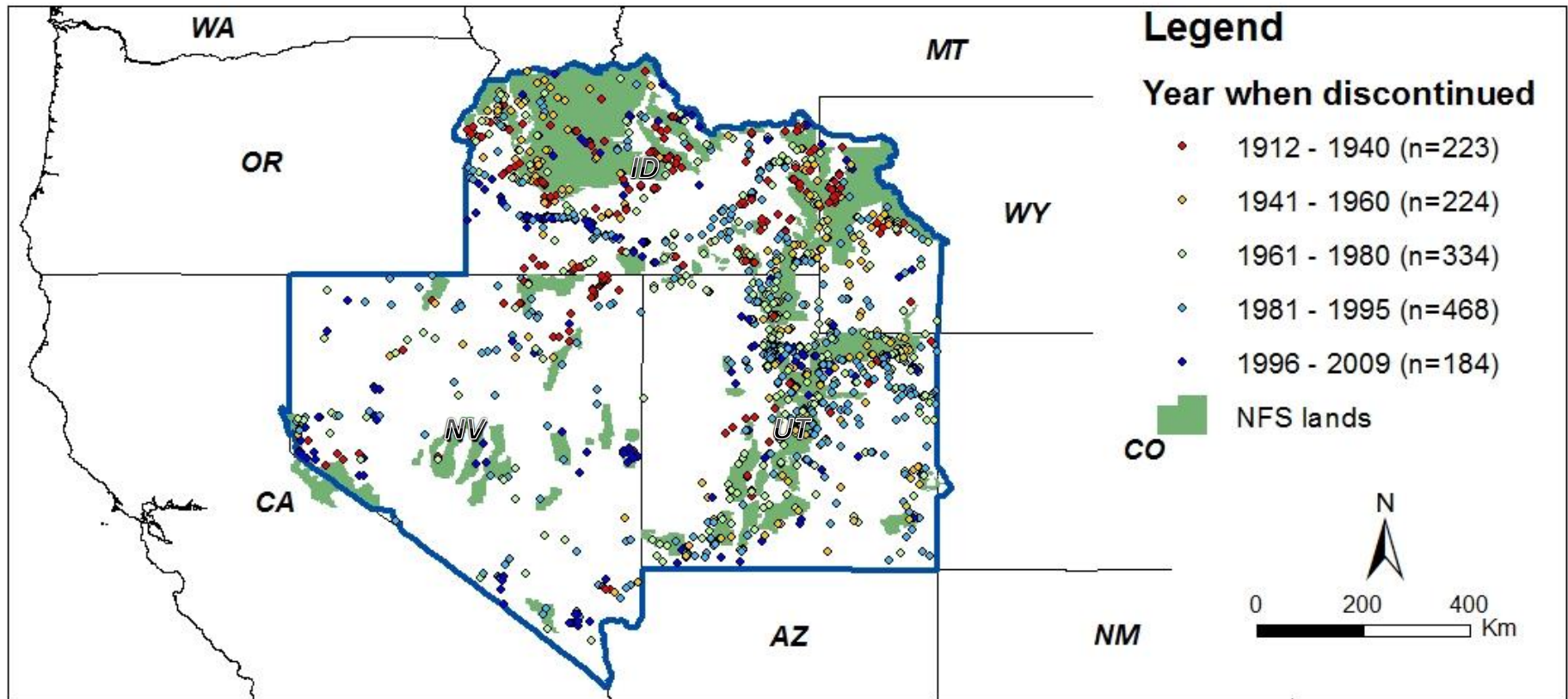
The next slide displays these data in a bar chart.

Years in Operation

USGS Stream Gages from 1912 - 2012 (n=1,930)



Year when Discontinued USGS Stream Gages from 1912 - 2009 (n=1,433)



Group 1

Stream Segments in Region 4

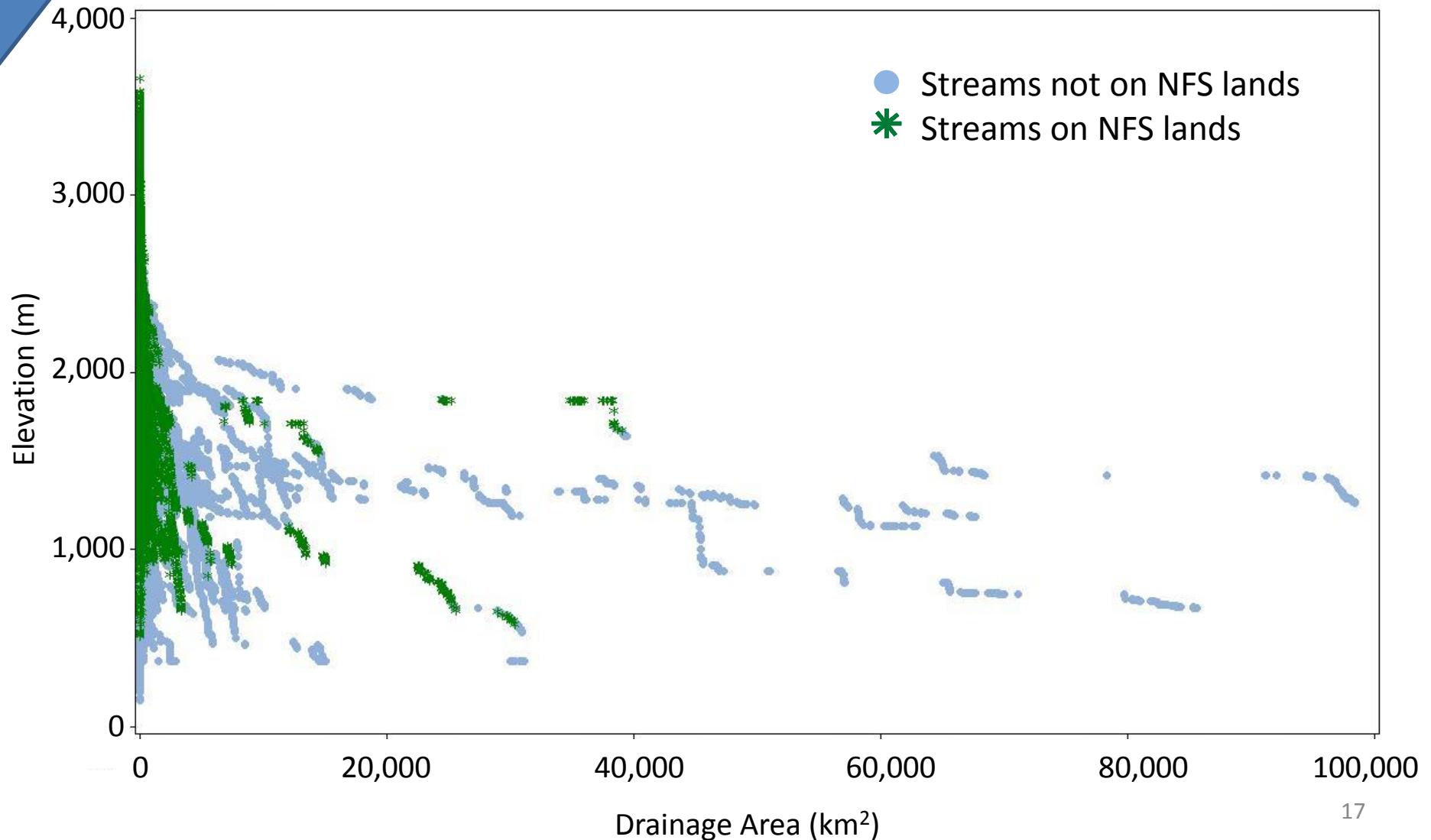
On the following 3 slides, each stream segment within Region 4 is plotted by elevation and drainage area.

Overlaid on the region's stream segments are the stream segments located on NFS lands.

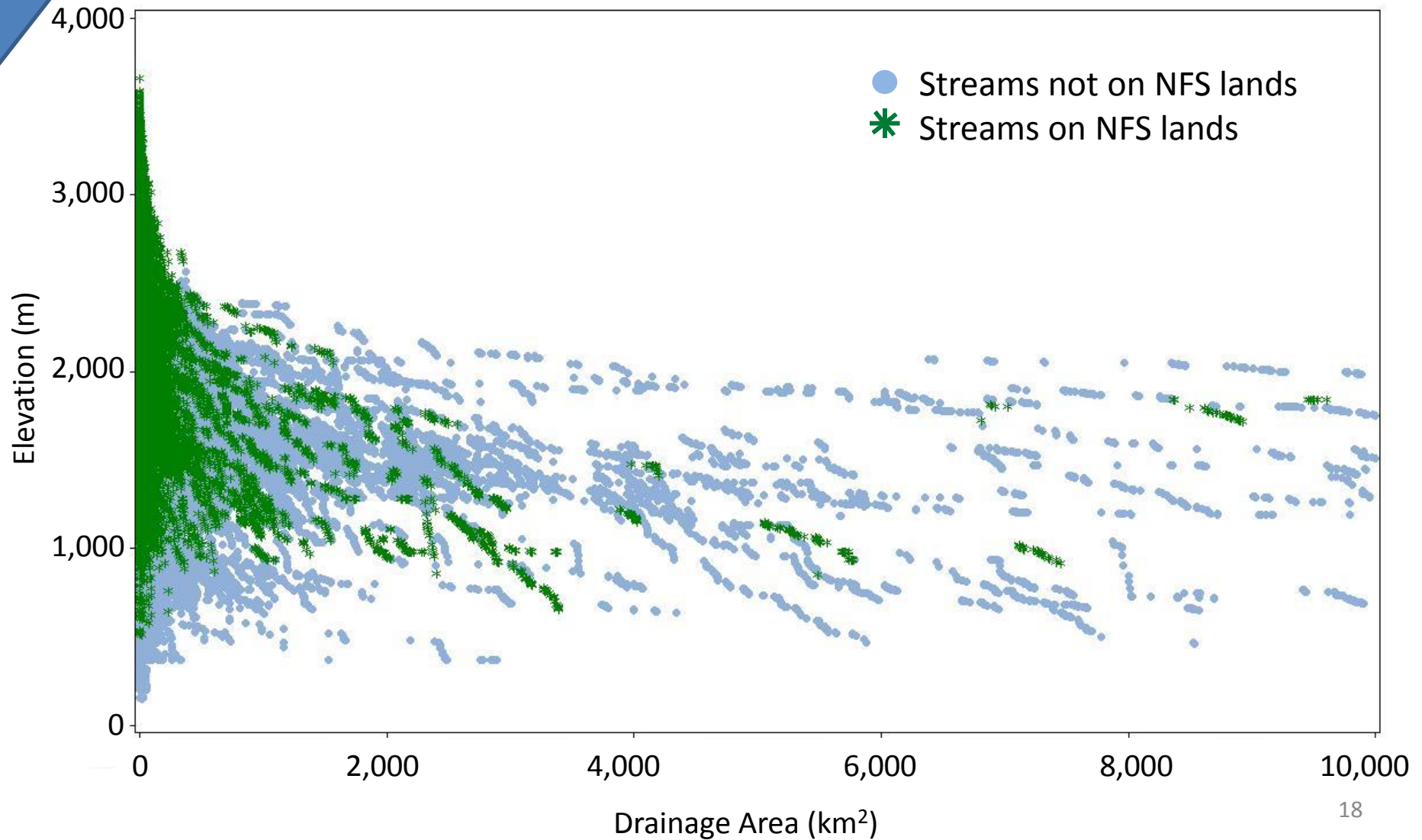
The first slide is truncated at 100,000 km² because the Mississippi River drains 3,000,000 km² and created a dramatically skewed plot.

The only difference between the slides is that for each successive slide the horizontal axis will be magnified.

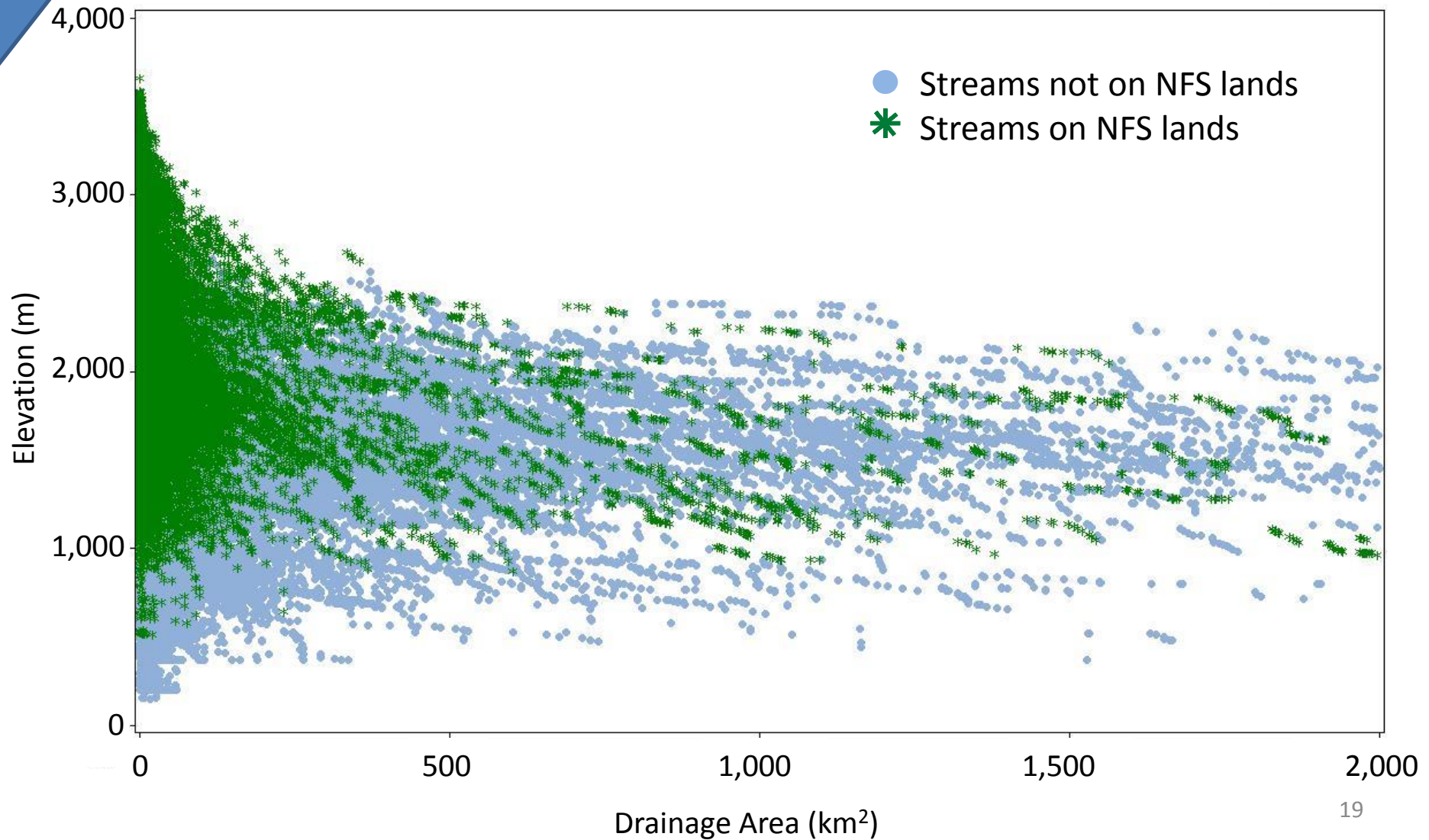
Stream Segments in Region 4



Stream Segments in Region 4



Stream Segments in Region 4



Group 2

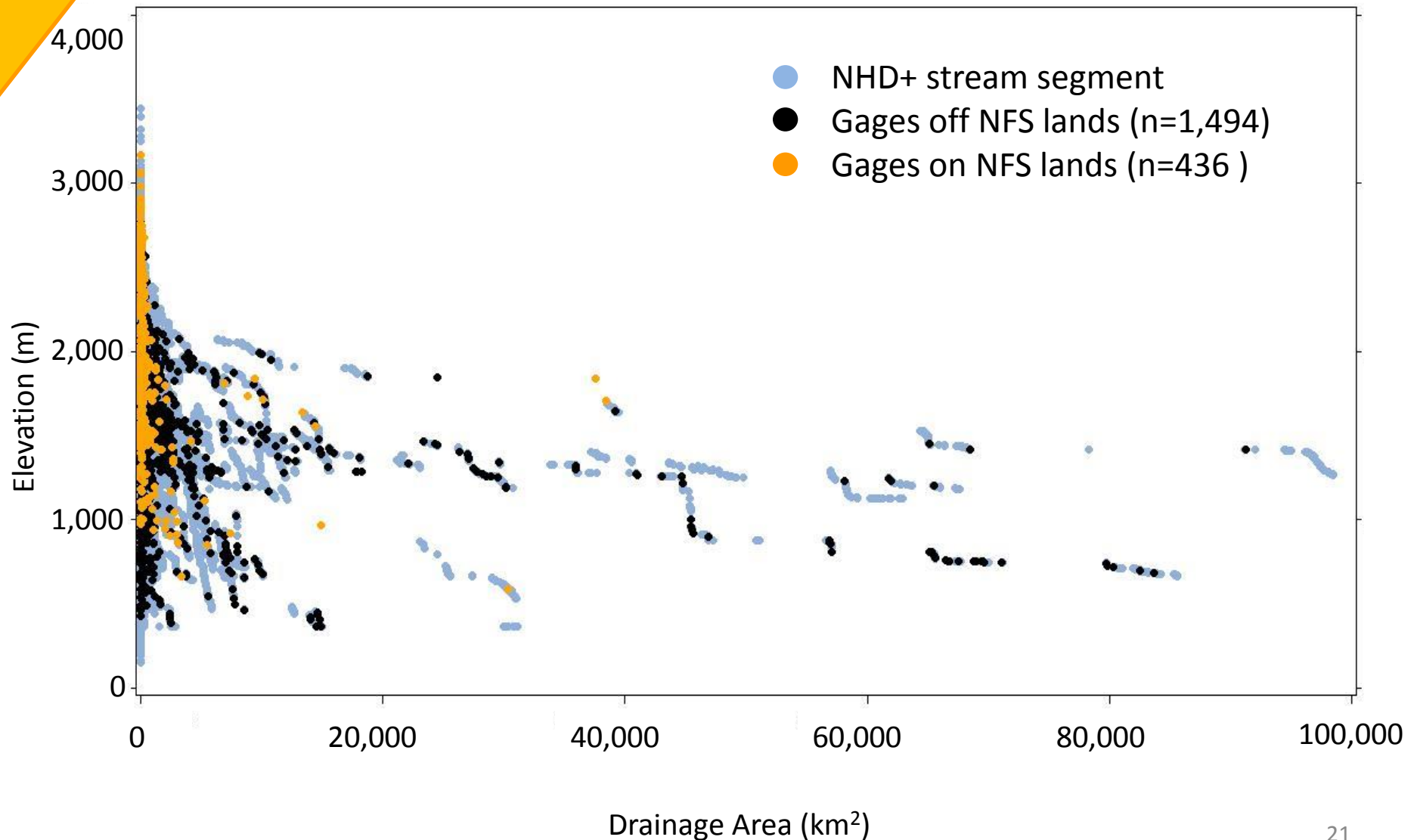
All Stream Gages - off and on NFS Lands

On the following 4 slides, each stream segment within Region 4 is plotted by elevation and drainage area (truncated at 100,000 km²).

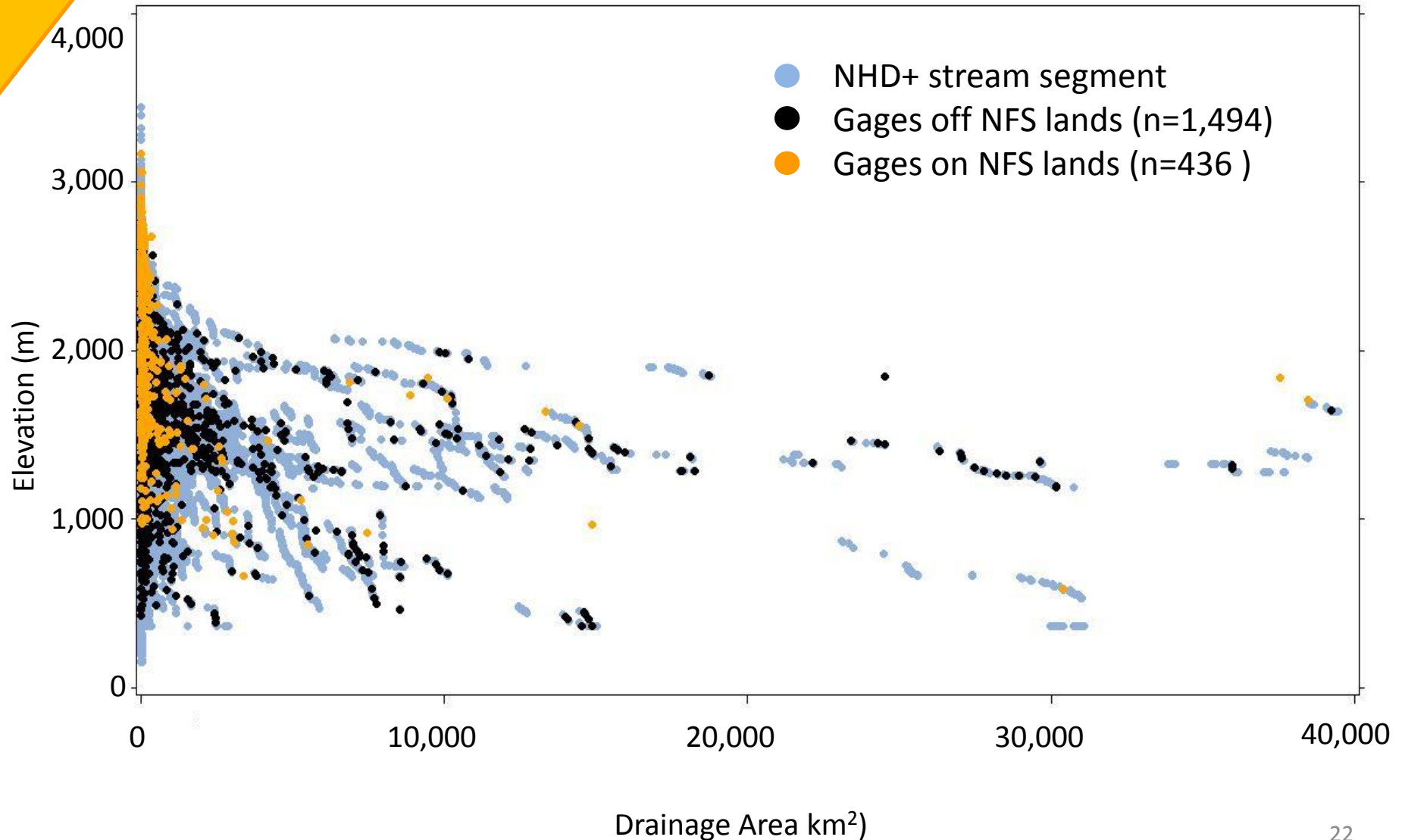
Overlaid on the stream segments are the 1,930 stream gages that are/were active since 1912. There are 1,494 gages that are not on NFS lands and 436 gages on NFS lands.

The only difference between the next few slides is that for each successive slide the horizontal axis will be magnified, as in Group 1.

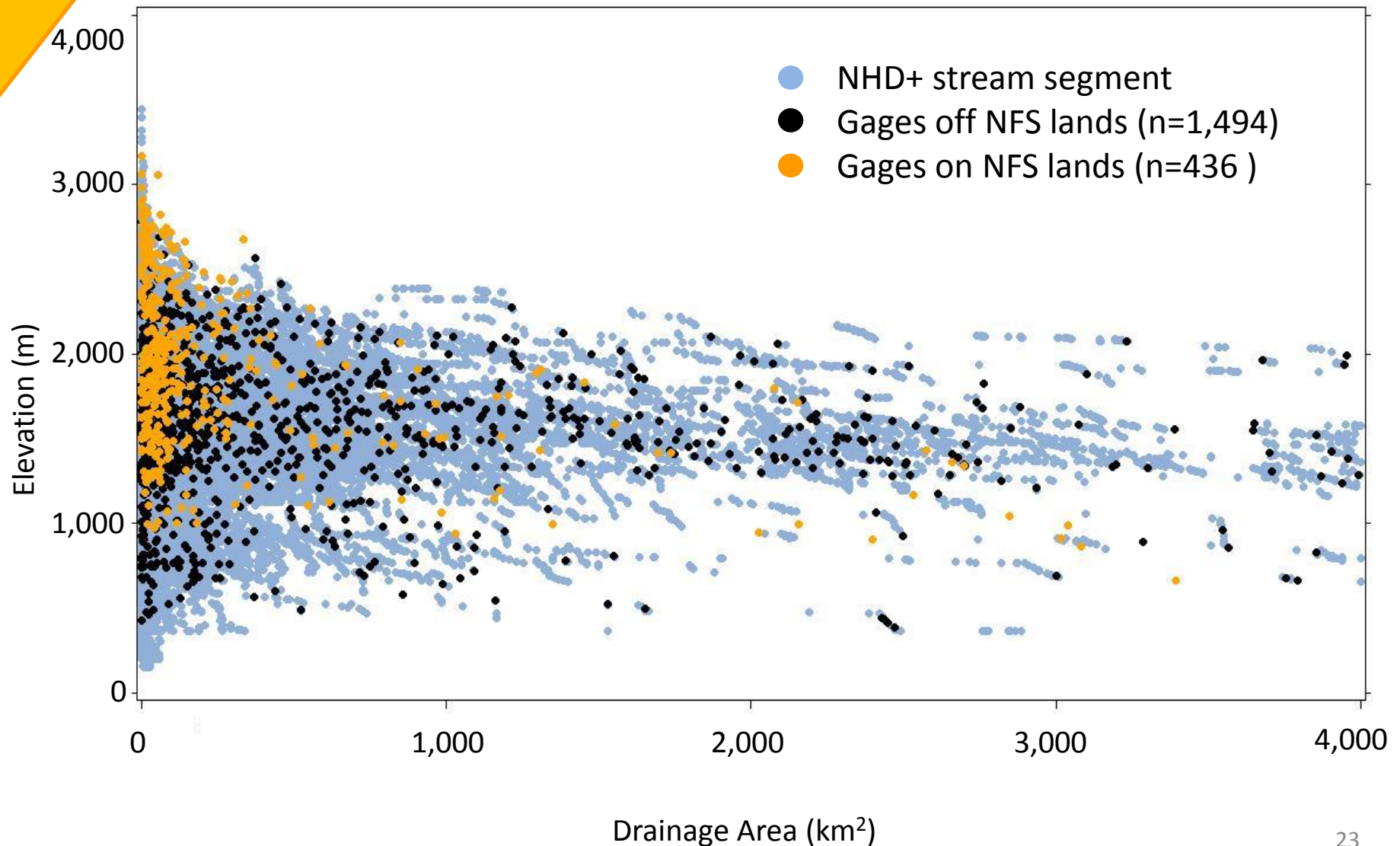
All Stream Gages - off and on NFS Lands



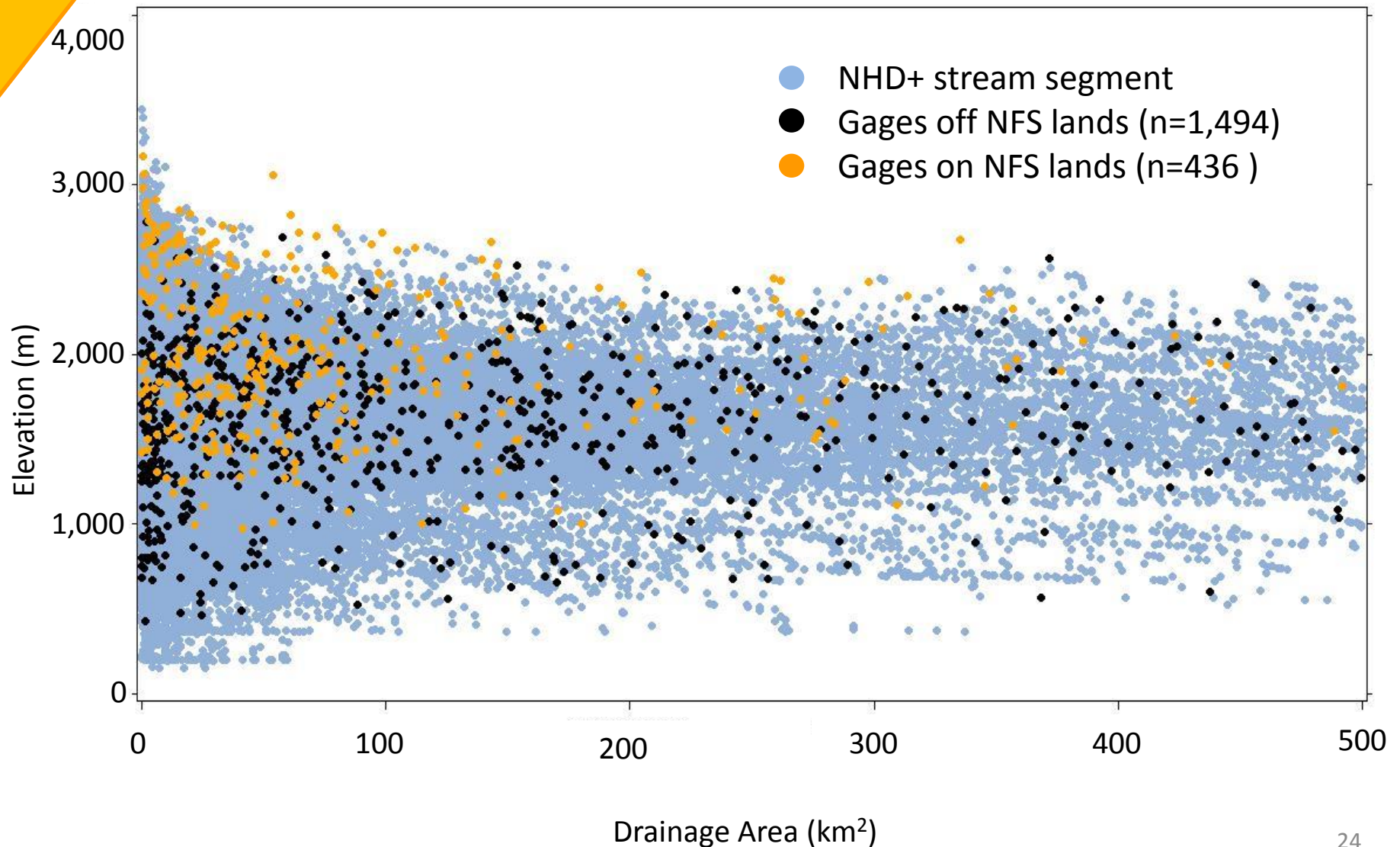
All Stream Gages - off and on NFS Lands



All Stream Gages - off and on NFS Lands



All Stream Gages - off and on NFS Lands



Group 3

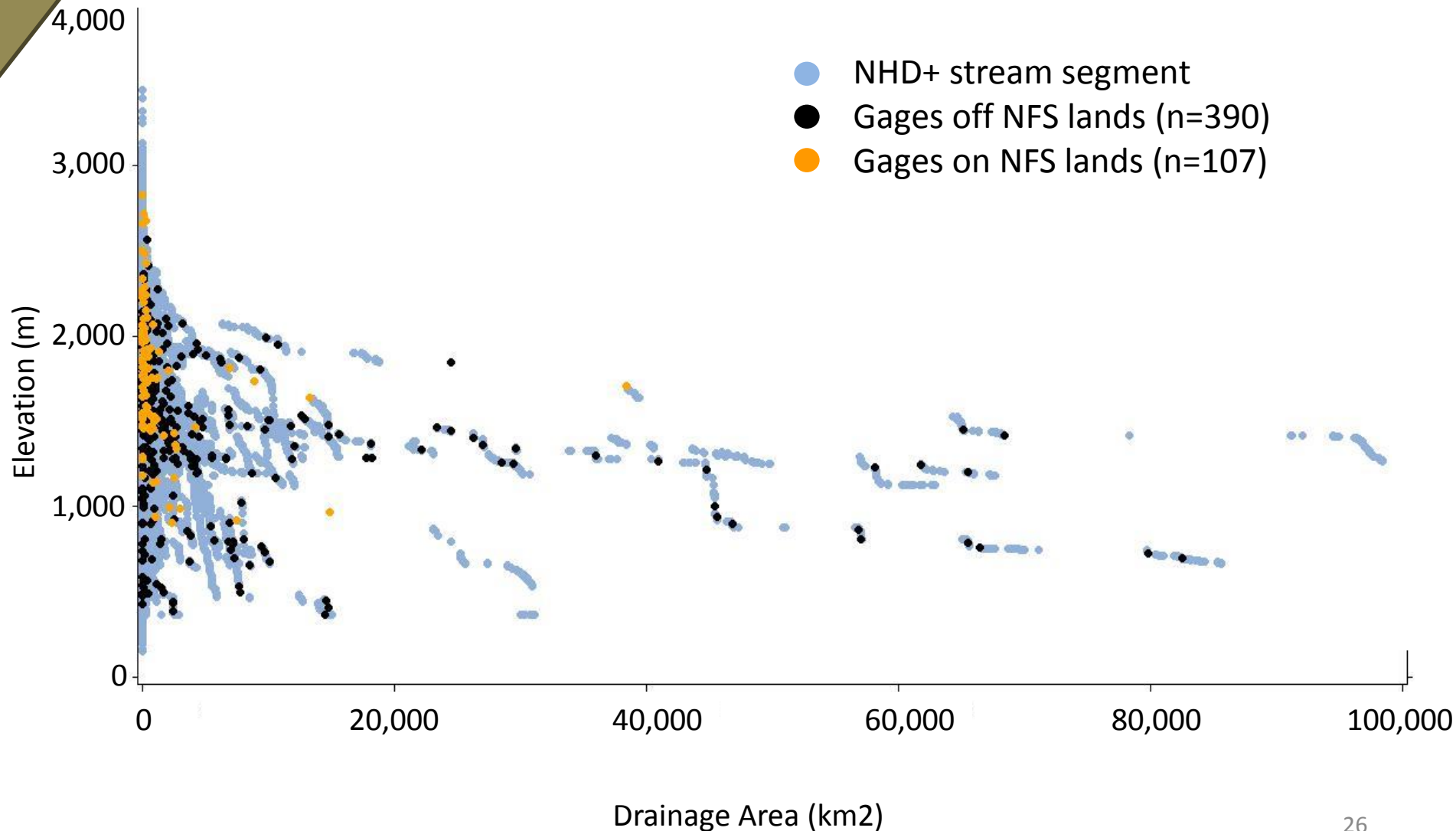
Current Stream Gages - off and on NFS Lands

On the following 3 slides, each stream segment within Region 4 is plotted by elevation and drainage area (truncated at 100,000 km²).

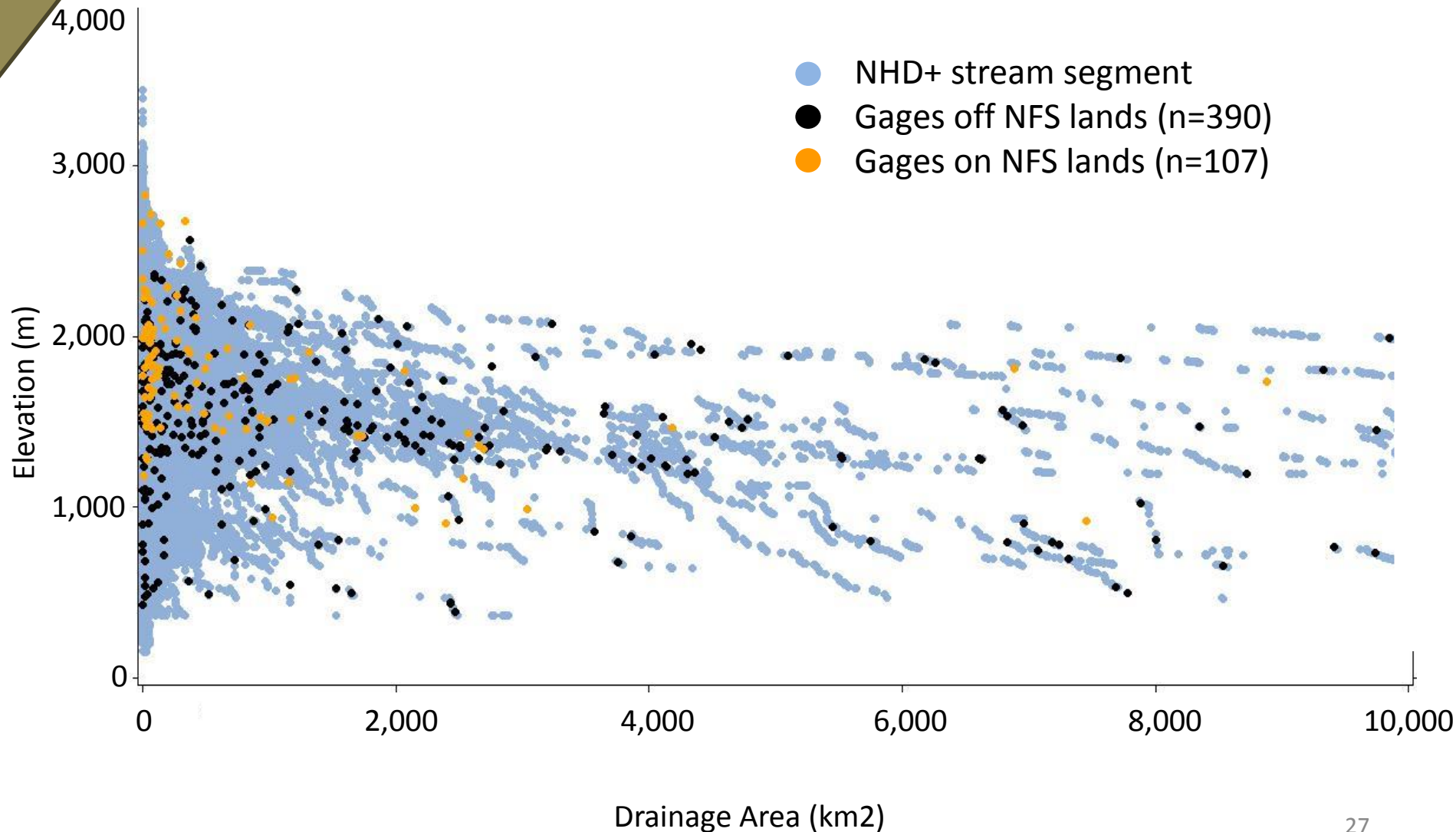
Overlaid on the stream segments are the 497 stream gages that are currently operational, as of January 2010. There are 390 gages operating off NFS lands and 107 gages on NFS lands.

The only difference between the next few slides is that for each successive slide, the horizontal axis will be magnified, as before.

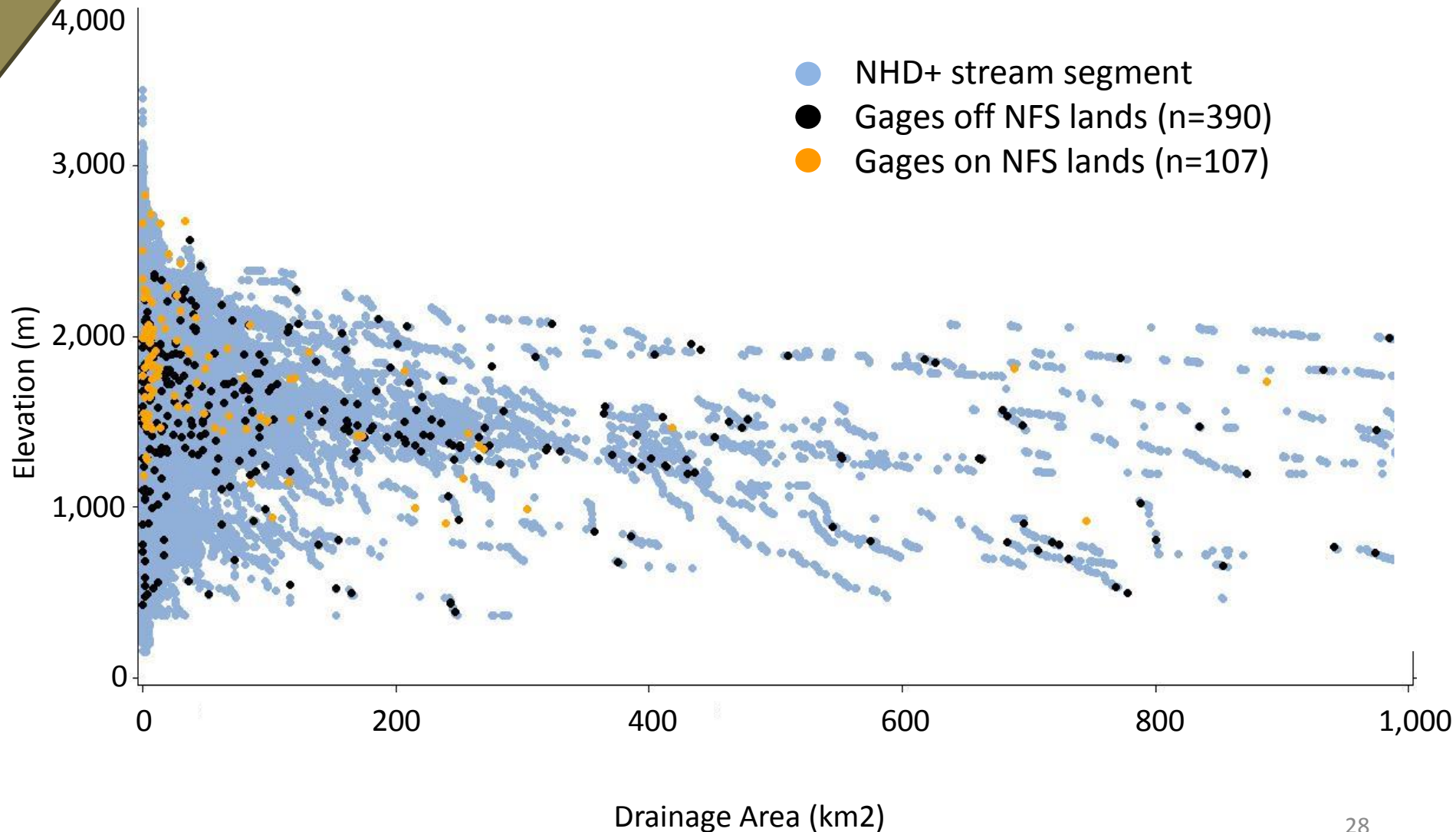
Current Stream Gages - off and on NFS Lands



Current Stream Gages - off and on NFS Lands



Current Stream Gages - off and on NFS Lands



Group 4

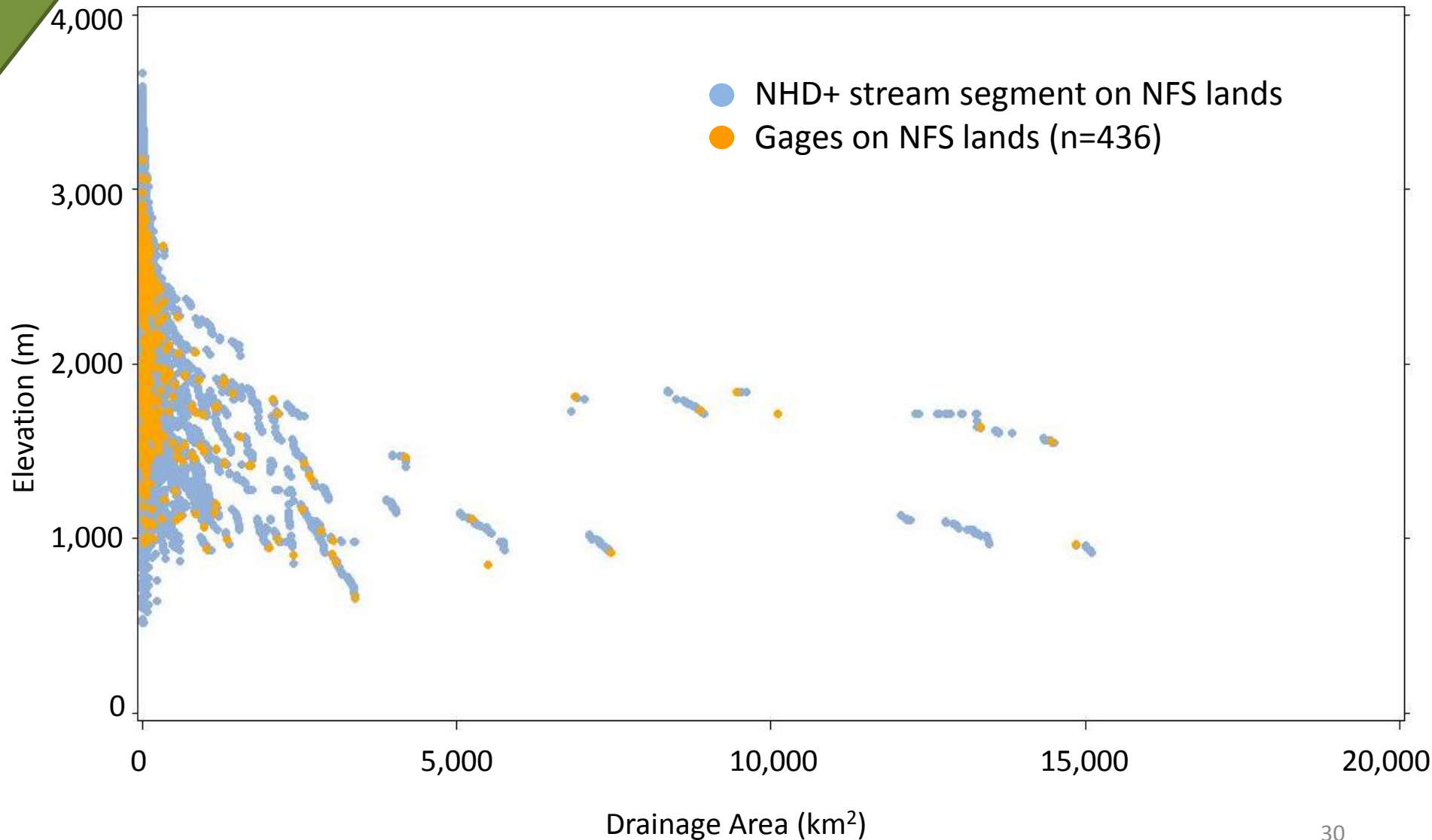
Streams and Historic Gages on NFS Lands

On the following 3 slides, we have plotted only the stream segments that are on NFS lands. Overlaid on the stream segments are 436 stream gages that are/were active since 1912.

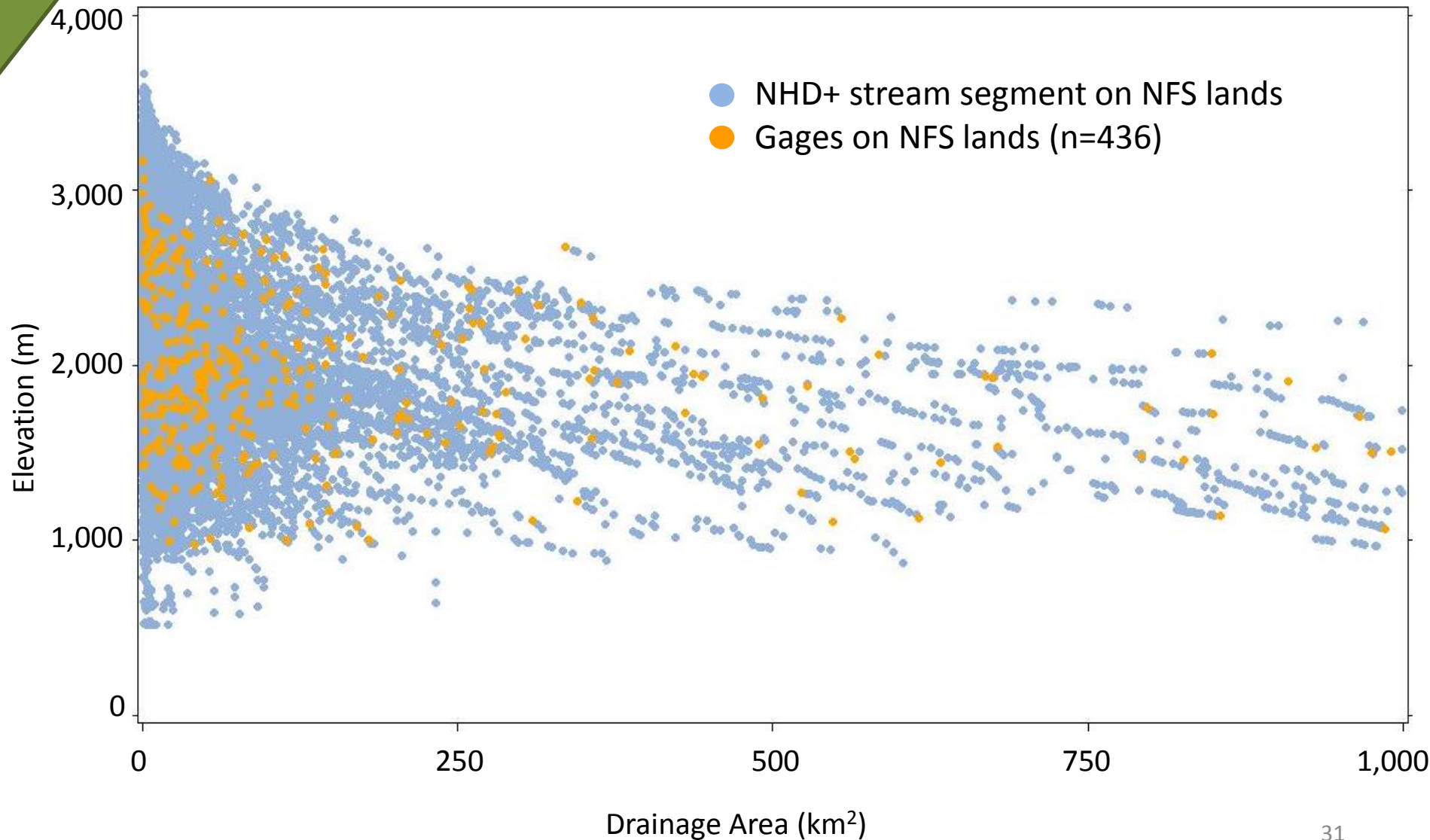
These slides allow us to see the available population of stream segments, relative to the distribution of gages that occur on the Forest, versus Group 2, which showed all stream segments in the entire region.

The only difference between the next few slides is that for each successive slide the horizontal axis will be magnified.

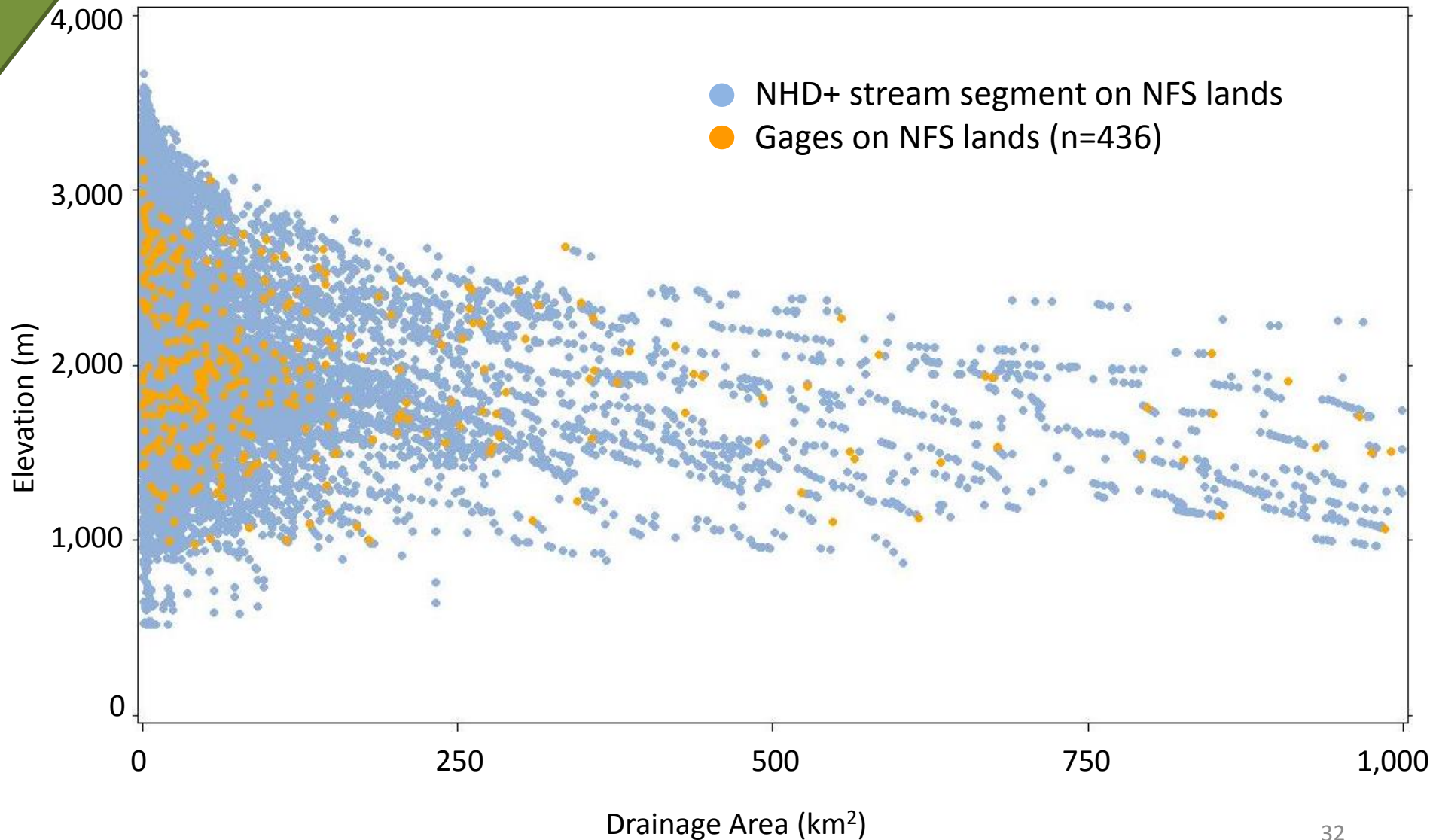
Streams and Historic Gages on NFS Lands



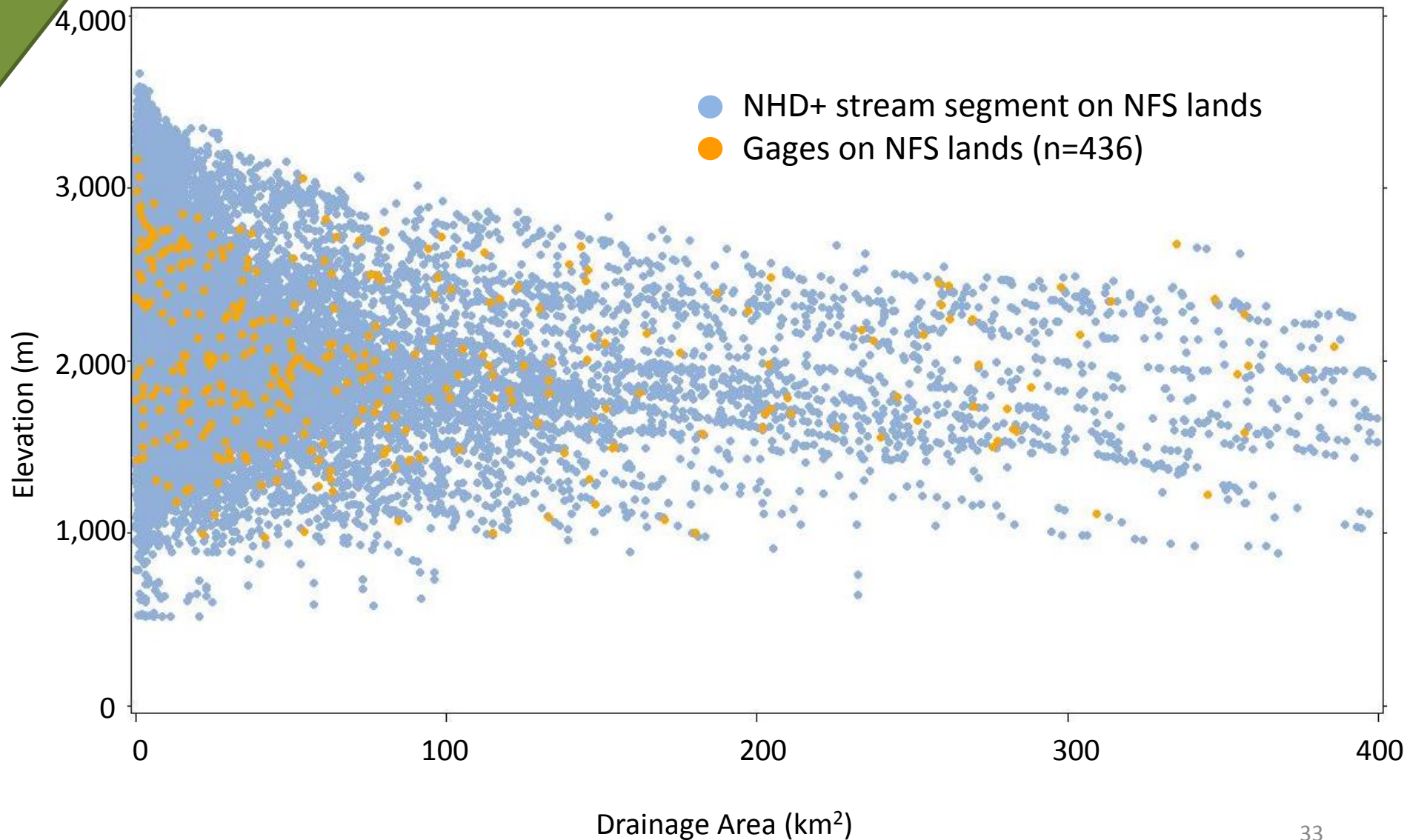
Streams and Historic Gages on NFS Lands



Streams and Historic Gages on NFS Lands



Streams and Historic Gages on NFS Lands



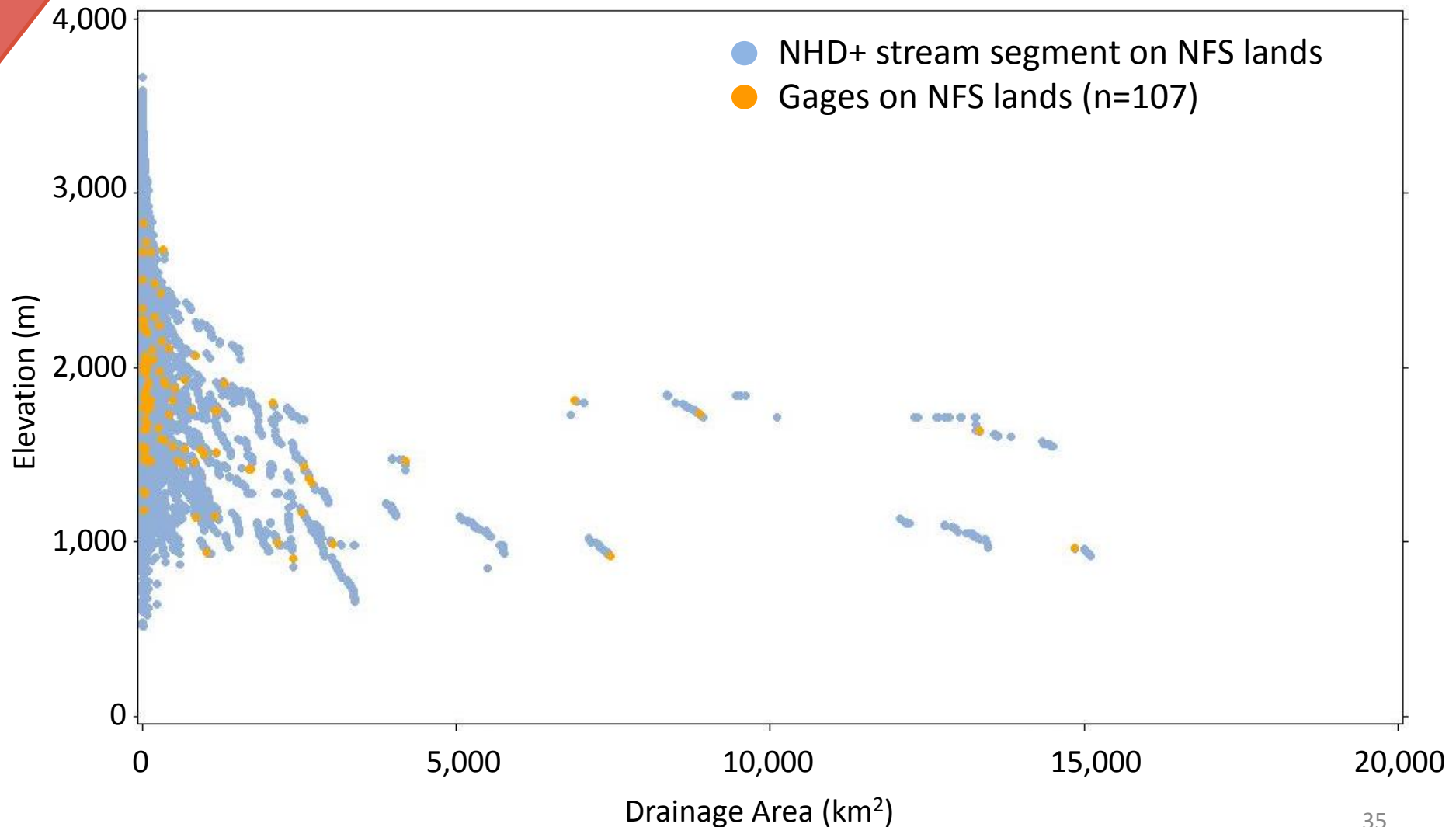
Group 5

Streams and Current Gages on NFS Lands

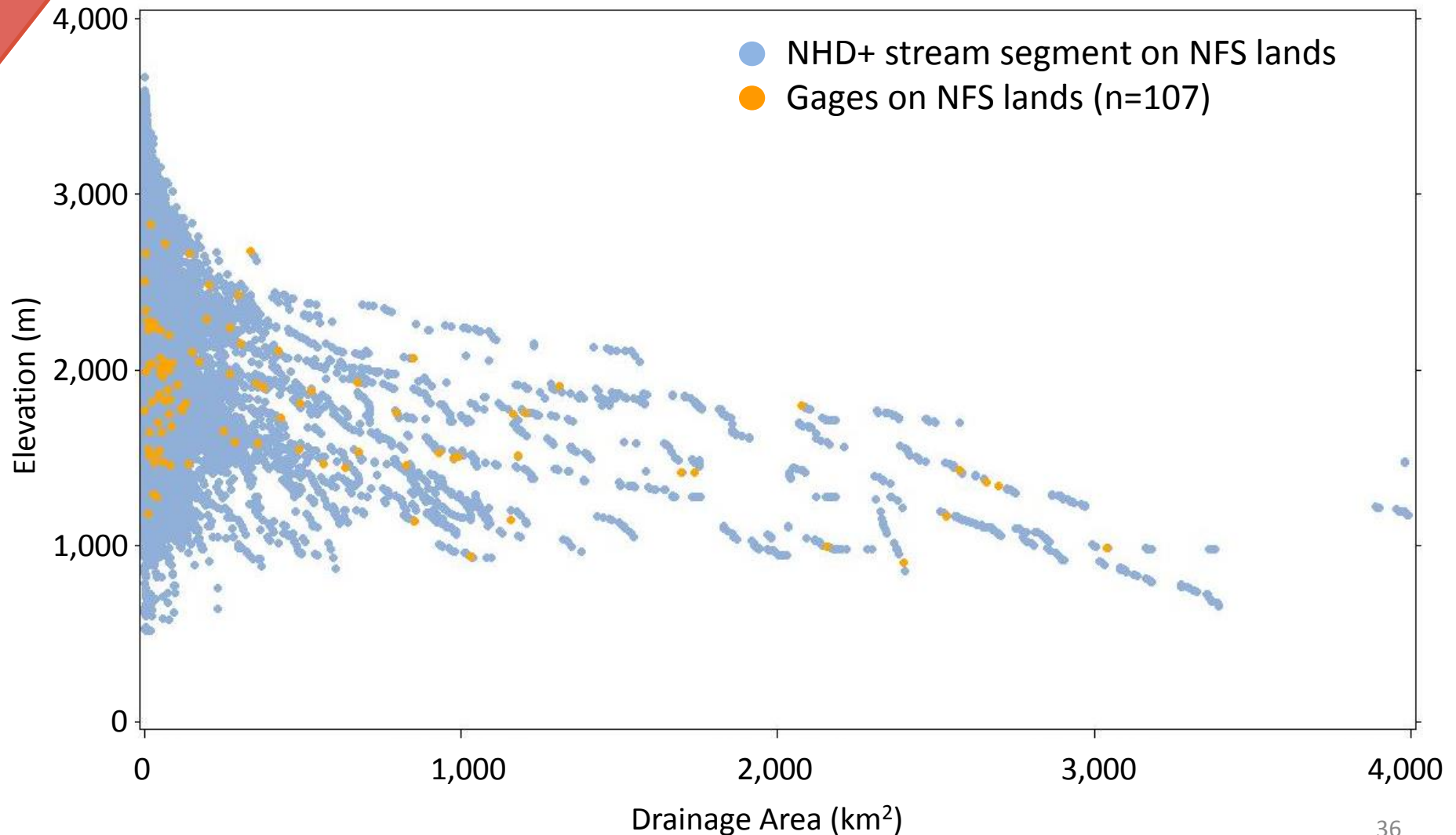
On the following 3 slides, we have plotted only stream segments that are on NFS lands. Overlaid on the stream segments are the 107 stream gages that are currently active as of January 2010.

For each successive slide the horizontal axis will be magnified.

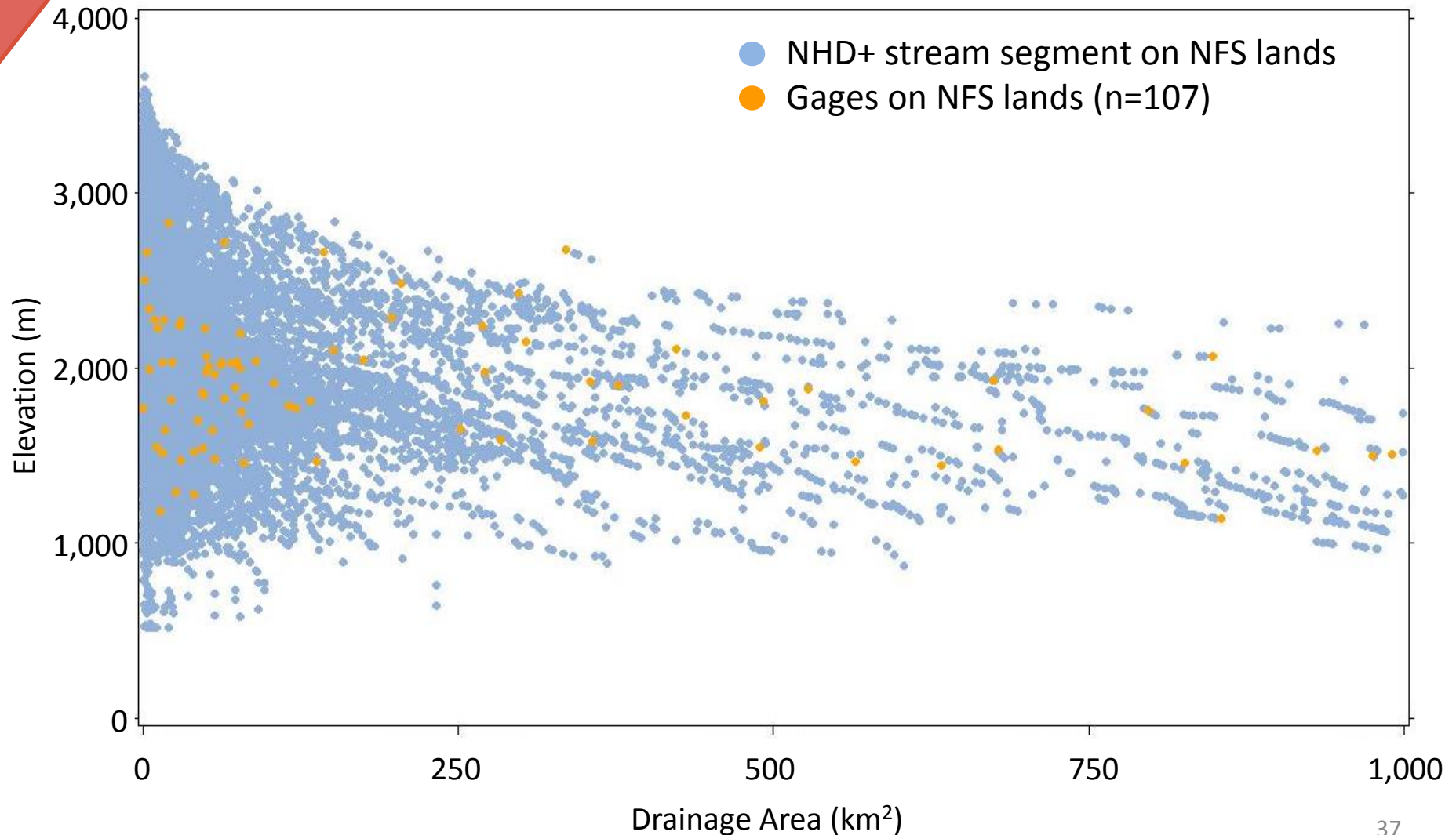
Streams and Current Gages on NFS Lands



Streams and Current Gages on NFS Lands



Streams and Current Gages on NFS Lands



Stream Gages Adjacent to NFS Lands

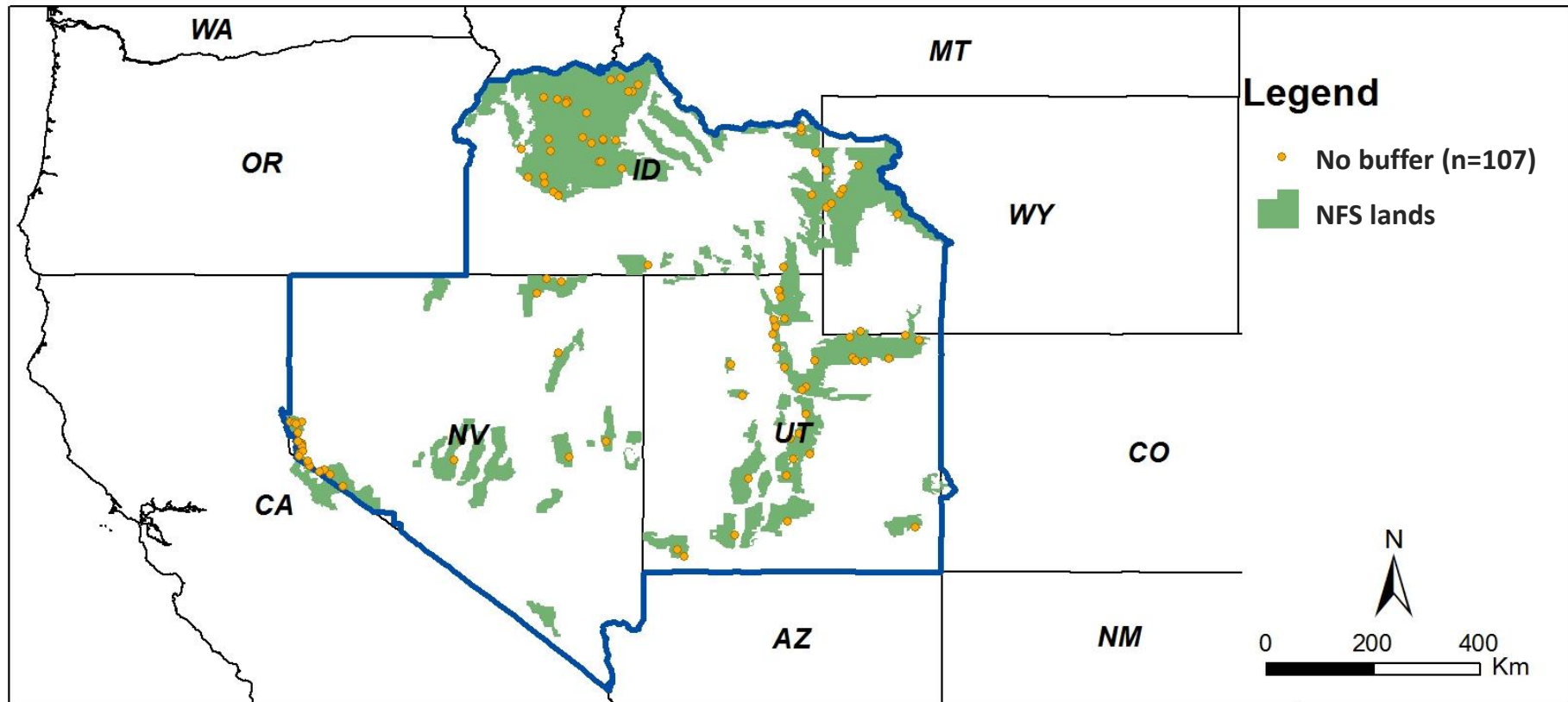
ISSUE

Many stream gages are located on waterways that are downstream of, and not on, a National Forest. In our analysis, only streams gages that touched a Forest boundary, using ArcGIS, were classified as a gage on NFS lands. This type of classification does not account for the tremendous amount of flow that influences gages immediately downstream of a Forest.

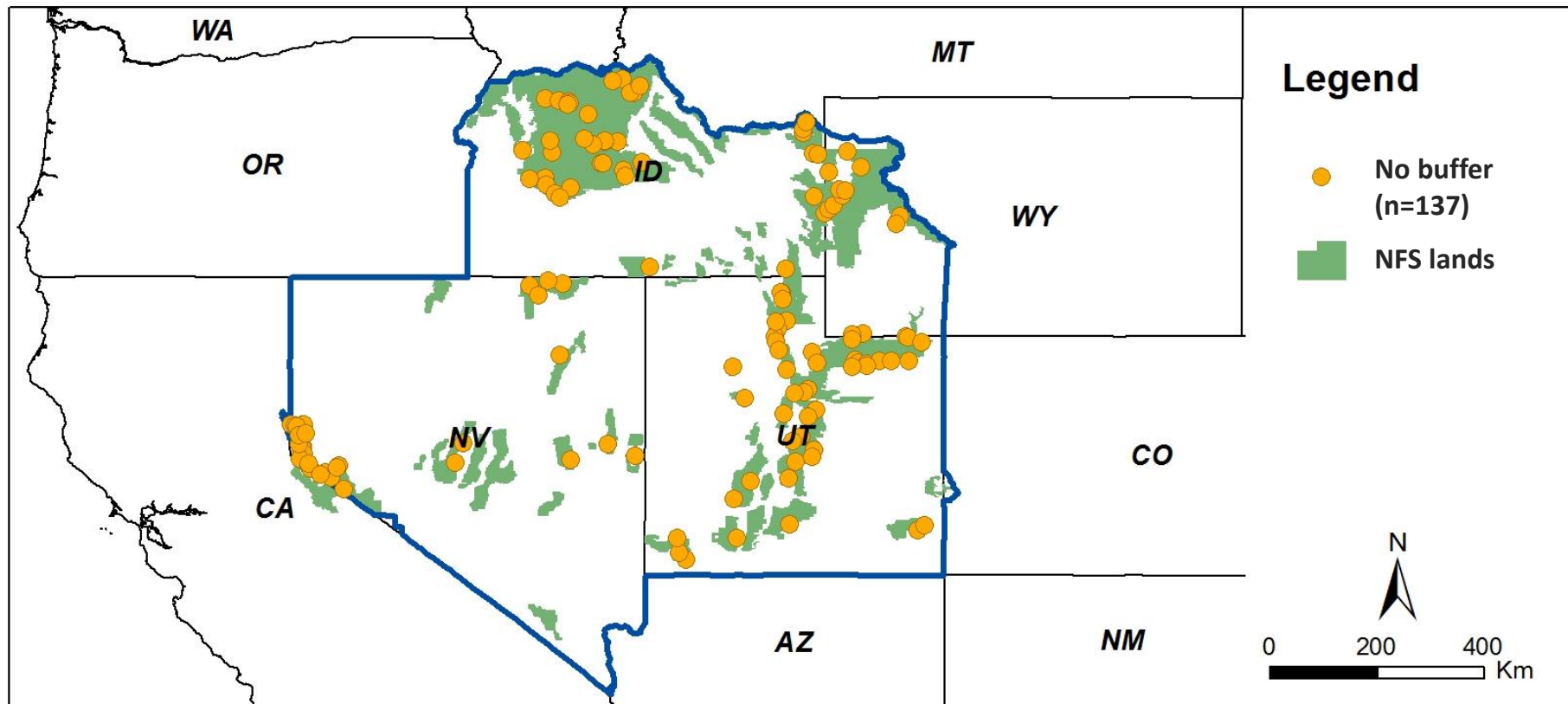
SOLUTION

On the next 6 slides we show the effect of adding a 1 Km and 10 Km buffer around the Forest boundary. We classified all gages within the buffer as being on NFS lands.

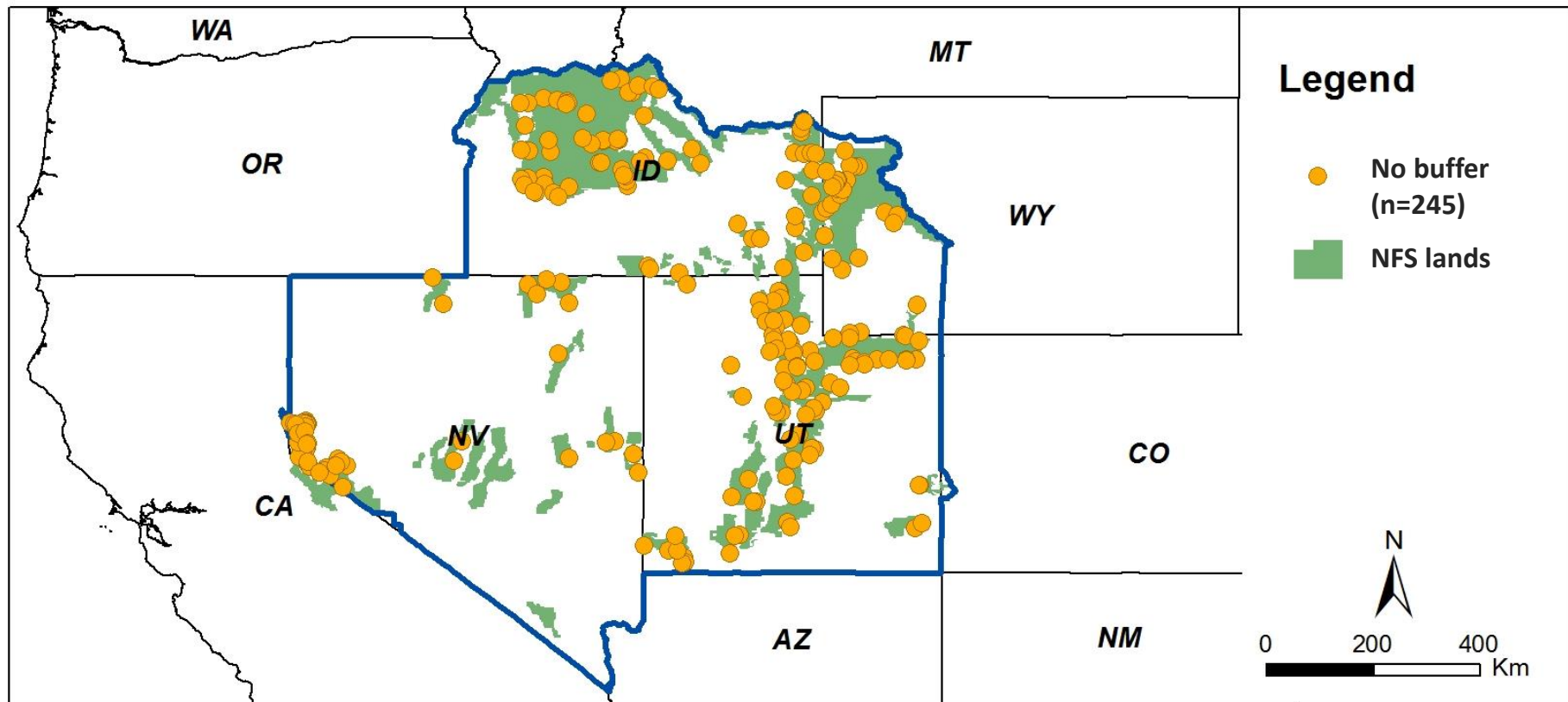
USGS Stream Gages Currently Operational: On NFS Land - **No Buffer**



USGS Stream Gages Currently Operational: On NFS Lands - **Within 1 Km**

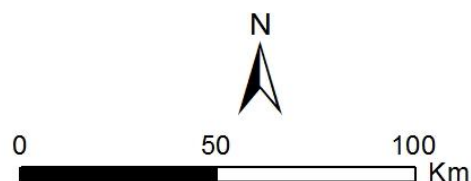
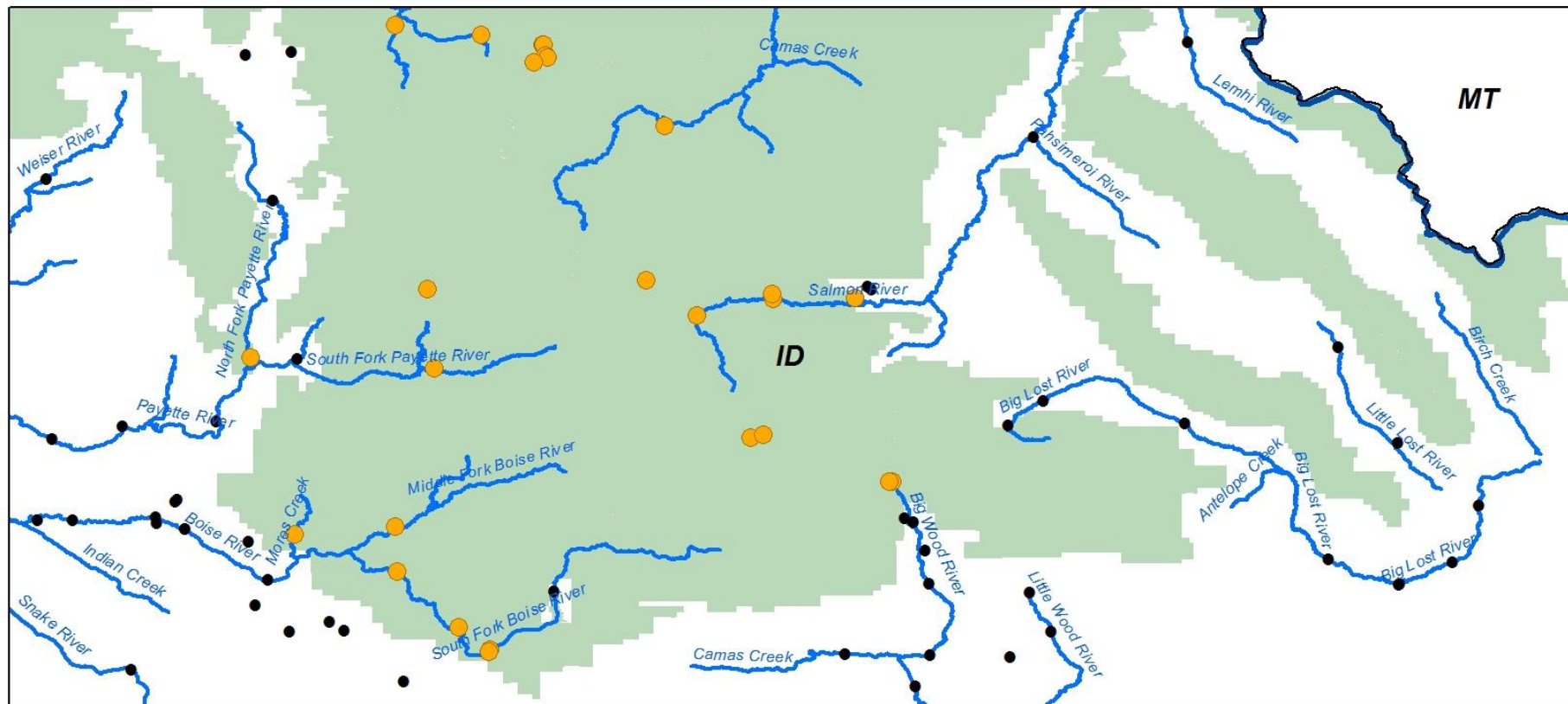


USGS Stream Gages Currently Operational: On NFS Lands - **Within 10 Km**



Within 100 Km of NFS (n=245)
NFS lands

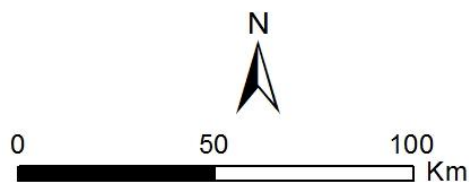
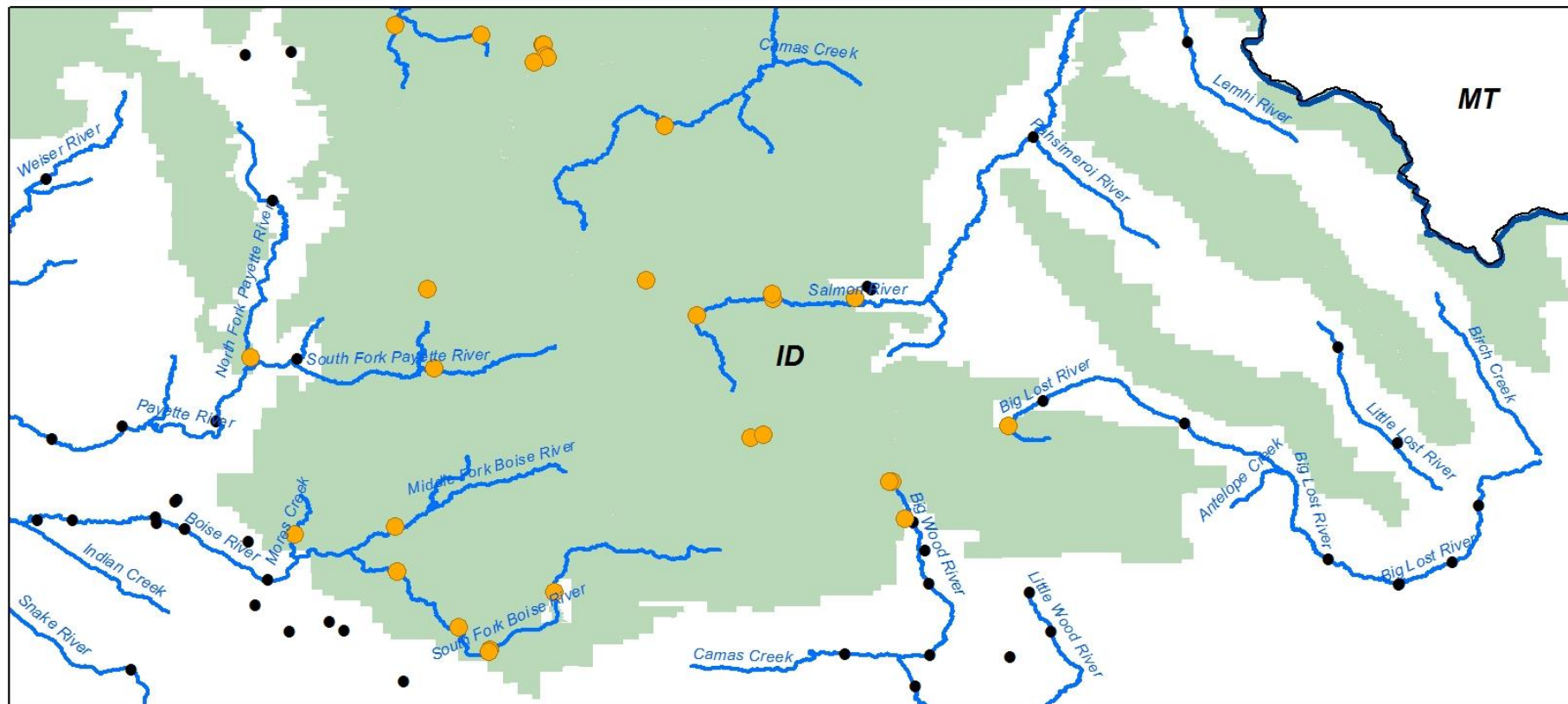
USGS Stream Gages Currently Operational: On NFS Lands - **No Buffer**



Legend

- No buffer (n=107)
- Not on NFS lands
- NFS lands

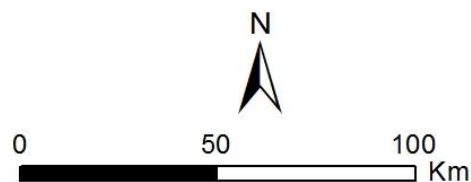
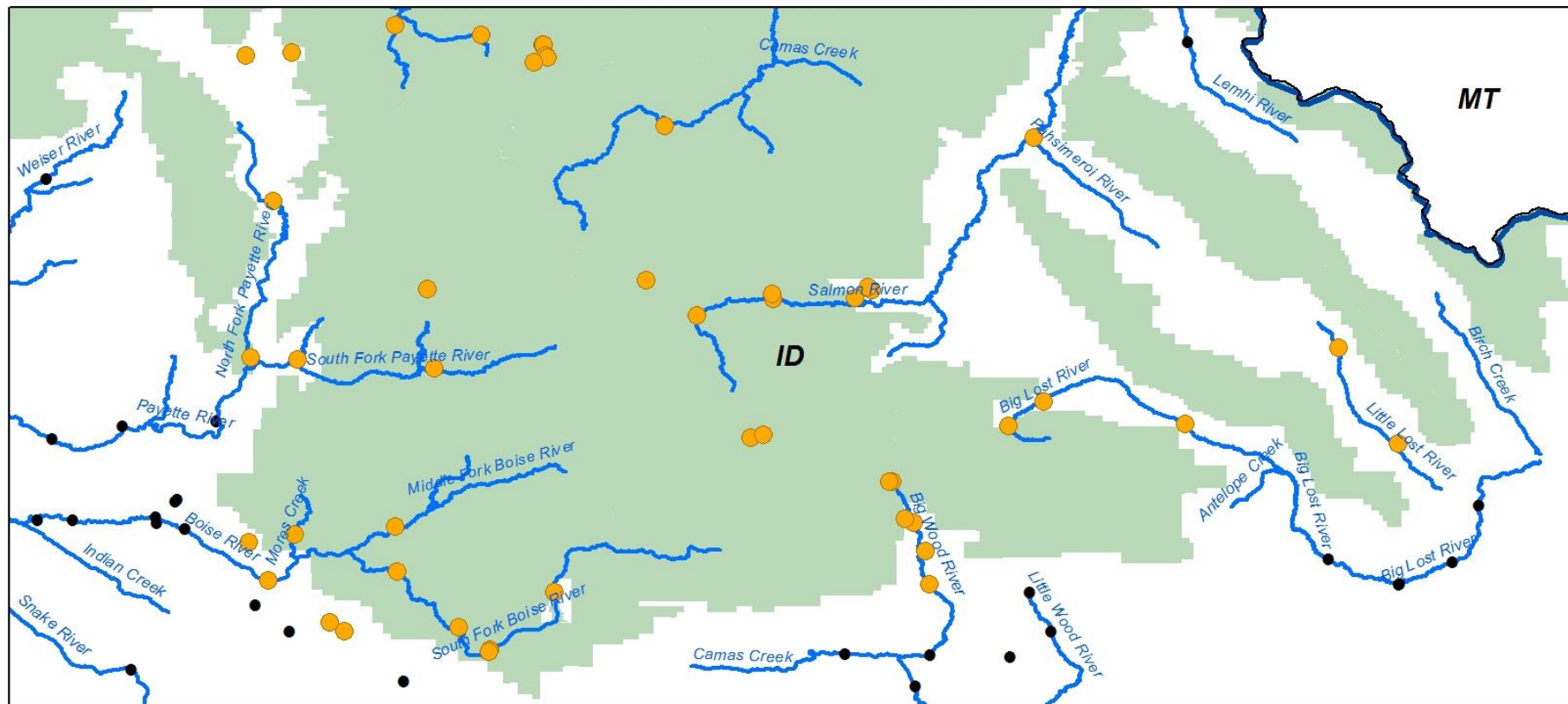
USGS Stream Gages Currently Operational: On NFS Lands - **Within 1 Km**



Legend

- Within 1 Km of NFS (n=137)
- Not on NFS lands
- NFS lands

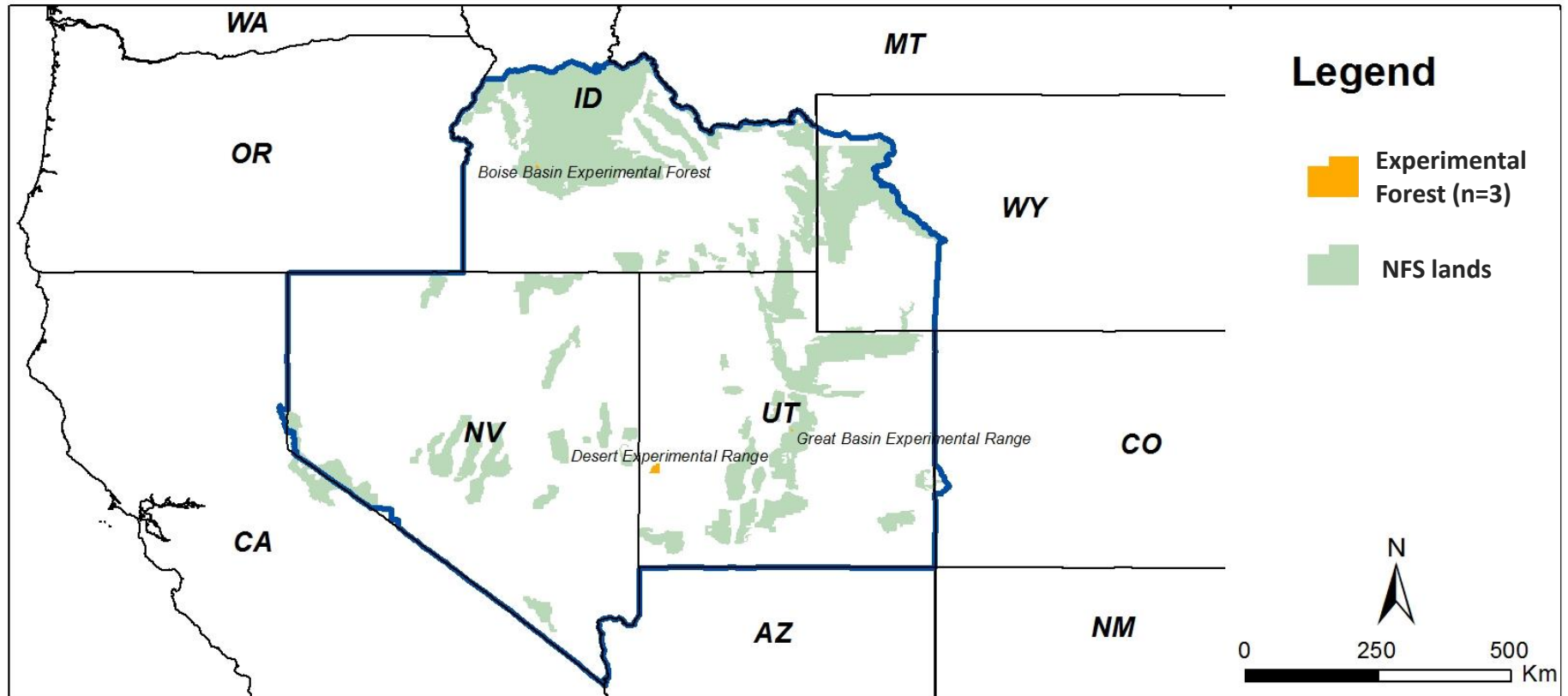
USGS Stream Gages Currently Operational: On NFS Lands - **Within 10 Km**



Legend

- Within 10 Km of NFS (n=245)
- Not on NFS lands
- NFS lands

Experimental Forests in Region 4



The End



Middle Fork Salmon River at Middle Fork Lodge near Yellow Pine, ID.